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REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE THIRD SESSION OF THE FIFTY-THIRD CONGRESS.

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CONTENTS

[Alphabetical index will be found at the end of each part.]

PART I.

OFFICERS OF THE CORPS OF ENGINEERS.

Status, changes, and distribution of officers of corps, 3; officers detached, 4.

FORTIFICATIONS.

Projects and estimates, 4; appropriations, 5; allotments, 6; Portland Harbor, Me., 6; Boston Harbor, Mass., Narragansett Bay, R. I., New York Harbor, N. Y., 7; Philadelphia, Pa., 9; Washington, D. C., Hampton Roads, Va., Savannah, Ga., Pensacola, Fla., San Franciso Harbor, Cal., 10; preservation and repair of fortifications, 12. Sites for fortifications: Fort McClary, Me., Cushings Island, Portland, Me., Grovers Cliff, Boston, Mass., Sullivans Island, Charleston, S. C., 13.

SEA WALLS AND EMBANKMENTS, NEW YORK HARBOR.

In the charge of Lieut. Col. H. M. Robert, Corps of Engineers—

Bedloes Island, Governors Island, Davids Island, 14.

SEA WALL AT FORT McHENRY, BALTIMORE HARBOR, MD.

In the charge of Col. Wm. P. Craighill, Corps of Engineers................14

WATER SUPPLY AT FORT MONROE, VA.

In the charge of Maj. Charles E. L. B. Davis, Corps of Engineers 14

ESTIMATES OF APPROPRIATIONS FOR FORTIFICATIONS REQUIRED FOR 1895–'96.................................... 15

THE BOARD OF ENGINEERS.

Constitution of Board, summary of reports rendered, 15; personal inspections made, additional duties of members, 16.

POST OF WILLETS POINT, NEW YORK.—U. S. ENGINEER SCHOOL.—BATTALION OF ENGINEERS.—ENGINEER DEPOT.

Officer in command, Lieut. Col. W. R. King, Corps of Engineers—

Post of Willets Point, U. S. Engineer School, Battalion of Engineers, 17; Engineer Depot, 18; statement of funds, estimates, 19.

RIVER AND HARBOR IMPROVEMENTS.

General statement, removal of wrecks, 19; establishment of harbor lines, examination of bills for bridges, construction of bridges across navigable waters, bridges obstructing navigation, occupancy and injury of public works, engineer divisions, South Pass of the Mississippi River, 20.

ATLANTIC COAST AND GULF OF MEXICO.

In the charge of Lieut. Col. Peter C. Hains, Corps of Engineers—

St. Croix River, Me., 20; Lubec Channel, Me., Moosabec Bar, Me., 21; Narraguagus River, Me., 22; breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me., 23; Bagaduce River, Me., Penobscot River, Me., 24; Belfast Harbor Me., Camden Harbor, Me., 26; Rockland Harbor, Me., 27; Kennebec River, Me., 28; Harraseeket River, Me., 29; Portland Harbor, Me., 30; channel in Back Cove, Portland, Me., 31; Saco River, Me., 32; York Harbor, Me., 33; Bellamy River, N. H., Cocheco River, N. H., 34; harbor of refuge at Little Harbor, N. H., 35.

In the charge of Lieut. Col. S. M. Mansfield, Corps of Engineers—

Newburyport Harbor, Mass., 36; Merrimac River, Mass., Powow River, Mass., 37; Ipswich River, Mass., 38; Essex River, Mass., harbor of refuge, Sandy Bay, Cape Ann, Mass., 39; Gloucester Harbor, Mass., 40; Manchester Harbor, Mass., Salem Harbor, Mass, 41; Lynn Harbor, Mass., 42; Winthrop Harbor, Mass., Mystic and Malden rivers, Mass., 43; Boston Harbor, Mass., 44; Weymouth River, Mass., 45; Hingham Harbor, Mass., Scituate Harbor, Mass., 46; Plymouth Harbor, Mass., Kingston Harbor, Mass., 47; Wellfleet Harbor, Mass., Provincetown Harbor, Mass., 48; Chatham Harbor, Mass., removing sunken vessels or craft obstructing or endangering navigation, 49.

In the charge of Capt. W. H. Bixby, Corps of Engineers—

Harbor of refuge at Hyannis, Mass., harbor of refuge at Nantucket, Mass., 50; Marthas Vineyard inner harbor at Edgartown, Mass., 51; harbor at Vineyard Haven, Mass., Wareham Harbor, Mass., 52; New Bedford Harbor, Mass., 53; Canapitsit Channel, Mass., Taunton River, Mass., 54; Pawtucket River, R. I., 55; Providence River and Narragansett Bay, R. I., 56; removal of Green Jacket Shoal, Providence River, R. I., Newport Harbor, R. I., 57; harbor of refuge at Point Judith, R. I., 58; harbor of refuge at Block Island, R. I., 59; Pawcatuck River, R. I. and Conn., 60; harbor of refuge at Stonington, Conn., 61; removing sunken vessels or craft obstructing or endangering navigation, 62.

In the charge of Lieut. Col. Henry M. Robert, Corps of Engineers—

Mystic River, Conn., Thames River, Conn., 64; Connecticut River, Mass. and Conn., 65; harbor of refuge at Duck Island Harbor, Conn., 67; Clinton Harbor, Conn., New Haven Harbor, Conn., 68; breakwaters at New Haven, Conn., 69; Milford Harbor, Conn., 70; Housatonic River, Conn., Bridgeport Harbor, Conn., 71; Black Rock Harbor, Conn., 72; Saugatuck River, Conn., Wilsons Point Harbor, Conn., 73; Five Mile River Harbor, Conn., 74; Stamford Harbor, Conn., harbor at Cos Cob and Mianus River, Conn., 75; Port Chester Harbor, N. Y., 76; Larchmont Harbor, N. Y., East Chester Creek, N. Y., 77; Greenport Harbor, N. Y., Port Jefferson Harbor, N. Y., 78; Huntington Harbor, N. Y., Glen Cove Harbor, N. Y., 79; Flushing Bay, N. Y., 80; Patchogue River, N. Y., Browns Creek, Sayville, N. Y., 81; removing sunken vessels or craft obstructing or endangering navigation, 82.

In the charge of Lieut. Col. G. L. Gillespie, Corps of Engineers—

Hudson River, N. Y., 83; harbor at Saugerties, N. Y., harbor at Rondout, N. Y., 84; Wappinger Creek, N. Y., 85; Harlem River, N. Y., 86; East River and Hell Gate, N. Y., 87; Newtown Creek, N. Y., 89; Buttermilk Channel, New York Harbor, 90; Gowanus Bay, N. Y., Red Hook, Gowanus Creek, and Bay Ridge channels, 91; New York Harbor, N. Y., 92; Jamaica Bay, N. Y., 93; Raritan Bay, N. J., 94; removing sunken vessels or craft obstructing or endangering navigation, 95.

In the charge of Capt. Thomas L. Casey, Corps of Engineers—

Sumpawanus Inlet, N. Y., 95; Canarsie Bay, N. Y., Sheepshead Bay, N. Y., 96; Arthur Kill, N. Y. and N. J., 97; channel between Staten Island and New Jersey, 98; Passaic River, N. J., 99; Elizabeth River, N. J., 100; Rahway River, N. J., 101; Raritan River, N. J., 102; South River, N. J., 103; Keyport Harbor, N. J., Mattawan Creek, N. J., 104; Shoal Harbor and Compton Creek, N. J., 105; Shrewsbury River, N. J., 106; Manasquan (Squan) River, N. J., 107; removing sunken vessels or craft obstructing or endangering navigation, 108.

In the charge of Maj. C. W. Raymond, Corps of Engineers—

Delaware River, N. J. and Pa., 108; harbor between Philadelphia, Pa., and Camden, N. J., 110; Schuylkill River, Pa., 111; ice harbor at Marcus Hook, Pa., ice harbor at head of Delaware Bay, Del., 112; construction of iron pier in Delaware Bay, near Lewes, Del., 113; Delaware Breakwater, Del., 114; Rancocas River, N. J., 115; Alloway Creek, N. J., Salem River, N. J., 116; Goshen Creek, N. J., removing sunken vessels or craft obstructing or endangering navigation, 117.

In the charge of William F. Smith, United States Agent, Major of Engineers, U. S. Army, retired—

Wilmington Harbor, Del., 118; ice harbor at New Castle, Del., Appoquinimink River, Del., 119; Smyrna River, Del., 120; Murderkill River, Del., 121; Mispillion River, Del., 122; Broadkiln River, Del., inland waterway from Chincoteague Bay, Va., to Delaware Bay, at or near Lewes, Del., 123; Susquehanna River above and below Havre de Grace, Md., Elk River, Md., 124; Fairlee Creek, Md., Chester River, Md., from Crumpton to Jones Landing, 125; Choptank River, Md., La Trappe River, Md., 126; Warwick River, Md., 127; Cambridge Harbor, Md., Broad Creek River, Del., 128; Wicomico River, Md., 129; Manokin River, Md., Onancock Harbor, Va., 130; harbor and approaches at Cape Charles City, Va., 131; removing sunken vessels or craft obstructing or endangering navigation, 132.

In the charge of Col. William P. Craighill, Corps of Engineers—

Patapsco River and channel to Baltimore, Md., 132; channel to Curtis Bay in Patapsco River, Baltimore Harbor, Md., James River, Va., 133.

In the charge of Maj. Charles E. L. B. Davis, Corps of Engineers—

Potomac River at Washington, D. C., 135; Anacostia River, D. C., Occoquan Creek, Va., 138; Aquia Creek, Va , 139; Nomini Creek, Va., 140; Lower Machodoc Creek, Va., Patuxent River, Md., 141; Rappahannock River, Va., 142; Urbana Creek, Va., York River, Va., 143; Mattaponi River, Va., 144; Pamunkey River, Va., removing sunken vessels or craft obstructing or endangering navigation, 145.

In the charge of Capt. Edward Burr, Corps of Engineers—

Harbor of Norfolk and its approaches, Va., 146; approach to Norfolk Harbor and the United States (Norfolk) navy-yard, between Lambert Point and Fort Norfolk, 147; Nansemond River, Va., 148; Chickahominy River, Va., Appomattox River, Va., 149; inland water route from Norfolk, Va., to Albemarle Sound, N. C., through Currituck Sound, 151; North Landing River, Va., and N. C., removing sunken vessels or craft obstructing or endangering navigation, 152.

In the charge of Maj. W. S. Stanton, Corps of Engineers—

Roanoke River, N. C., 153; Pasquotank River, N. C., 154; Mackeys Creek, N. C., Ocracoke Inlet, N. C., 155; Fishing Creek, N. C., Pamlico and Tar rivers, N. C., 156; Contentnia Creek, N. C., 157; Trent River, N. C., 158; Neuse River, N. C., inland waterway between Newbern and Beaufort, N. C., 159; harbor at Beaufort, N. C., 160; inland waterway between Beaufort Harbor and New River, N. C., inland waterway between New River and Swansboro, N. C., 161; New River, N. C., 162; North East (Cape Fear) River, N. C., Black River, N. C., 163; Cape Fear River above Wilmington, N. C., Cape Fear River at and below Wilmington, N. C., 164; Lockwoods Folly River, N. C., Georgetown Harbor, S. C., 166; Winyaw Bay, S. C., 167; removing sunken vessels or craft obstructing or endangering navigation, 168.

In the charge of Capt. Frederic V. Abbot, Corps of Engineers—

Waccamaw River, N. C. and S. C., 168; Lumber River, N. C. and S. C., Little Pedee River, S. C., 169; Great Pedee River, S. C., Clark River, S. C., Mingo Creek, S. C., Santee River, S. C., 170; Wateree River, S. C., Congaree River, S. C., 171; Charleston Harbor, S. C., Ashley River, S. C., 172; Wappoo Cut, S. C., Edisto River, S. C., Salkahatchie River, S. C., 173; Beaufort River, S. C., removing sunken vessels or craft obstructing or endangering navigation, 174.

IN THE CHARGE OF CAPT. O. M. CARTER, CORPS OF ENGINEERS—

Savannah Harbor, Ga., 174; Savannah River, Ga., 176; Savannah River above Augusta, Ga., Darien Harbor, Ga., 177; Altamaha River, Ga., 178; Oconee River, Ga., Ocmulgee River, Ga., 179; Brunswick Harbor, Ga., Brunswick Outer Bar, Ga., 180; Jekyl Creek, Ga., Cumberland Sound, Ga., 181; inside water route between Savannah, Ga., and Fernandina, Fla., removing sunken vessels or craft obstructing or endangering navigation, 182.

IN THE CHARGE OF MAJ. THOMAS H. HANDBURY, CORPS OF ENGINEERS—

St. Johns River, Fla., 182; Upper St. Johns River, Fla., 185; Volusia Bar, Fla., 186; Ocklawaha River, Fla., St. Augustine Harbor, Fla., 187; Indian River, Fla., 188; northwest entrance, Key West Harbor, Fla., 189; Caloosahatchee River, Fla., 190; Charlotte Harbor and Pease Creek, Fla., Sarasota Bay, Fla., 191; Manatee River, Fla., 192; Tampa Bay, Fla., Withlacoochee River, Fla., 193; harbor at Cedar Keys, Fla., 194; Suwanee River, Fla., 195.

IN THE CHARGE OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS—

Apalachicola Bay, Fla., 196; Apalachicola River, the Cut-off, and Lower Chipola River, Fla., 197; Flint River, Ga., 198; Chattahoochee River, Ga. and Ala., 200; Choctawhatchee River, Fla. and Ala., 202; harbor at Pensacola, Fla., 203; Escambia and Conecuh rivers, Fla. and Ala., 204; Alabama River, Ala., 205; Coosa River, Ga. and Ala., 206; operating and care of canals and other works of navigation on Coosa River, Ga. and Ala., 208; Cahaba River, Ala., 209.

IN THE CHARGE OF MAJ. A. N. DAMRELL, CORPS OF ENGINEERS—

Mobile Harbor, Ala., 210; Black Warrior River, Ala., from Tuscaloosa to Daniels Creek, 211; Warrior and Tombigbee rivers, Ala. and Miss., 212; Noxubee River, Miss., 214; Pascagoula River, Miss., Chickasahay River, Miss., 215; Leaf River, Miss., harbor at Biloxi, Miss., 216; Pearl River below Jackson, Miss., Pearl River between Carthage and Jackson, Miss., 217; Pearl River between Edinburg and Carthage, Miss., Bogue Chitto, La., 218; removing sunken vessels or craft obstructing or endangering navigation, 219.

IN THE CHARGE OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS—

Inspection of the improvement of the South Pass of the Mississippi River, 219; Chefuncte River and Bogue Falia, La., 220; Tickfaw River and its tributaries, La., 221; Amite River and Bayou Manchac, La., 222; Bayou Lafourche, La., Bayou Terrebonne, La., 223; Bayou Plaquemine, Grand River. and Pigeon bayous, La., 224. Bayou Courtableau, La., 225; Bayou Teche, La., 226; channel, bay, and passes of Bayou Vermillion, La., Mermentau River and tributaries, La., 227; mouth and passes of Calcasieu River, La., 228; harbor at Sabine Pass, Tex., 230; Sabine River, Tex., 231; Neches River, Tex., removing sunken vessels or craft obstructing or endangering navigation, 232.

IN THE CHARGE OF CAPT. JOHN MILLIS, CORPS OF ENGINEERS—

Securing mouth of Bayou Plaquemine, La., from further caving, 232.

IN THE CHARGE OF MAJ. A. M. MILLER, CORPS OF ENGINEERS—

Entrance to Galveston Harbor, Tex., 233; ship channel in Galveston Bay, Tex., 234; channel in West Galveston Bay, Tex., Trinity River, Tex., 235; Cedar Bayou, Tex., 236; Buffalo Bayou, Tex., harbor at Brazos Santiago, Tex., 237.

WESTERN RIVERS.

IN THE CHARGE OF CAPT. J. H. WILLARD, CORPS OF ENGINEERS—

Red River, La. and Ark., 238; Red River above Fulton, Ark., 240; Ouachita and Black rivers, Ark. and La., 241; bayous D'Arbonne and Corney, La., Bayou Bartholomew, La. and Ark., 242; Bœuf River, La., 243; Tensas River and Bayou Maçon, La., Big Black River, Miss., 244; Yazoo River, Miss., 245; mouth of Yazoo River, Miss., 246; Tchula Lake, Miss., Tallahatchee River, Miss., 247; Steele and Washington bayous, Miss., Big Sunflower River, Miss., 248; Big Hatchee River, Tenn., 249; Forked Deer River, Tenn., water gauges on Mississippi River and its principal tributaries, 250.

In the charge of Capt. Carl F. Palfrey, Corps of Engineers—

Removing obstructions in Arkansas River, 251; improving Arkansas River, Ark., Fourche Le Fevre, Ark., 252; Petit Jean River, Ark., White River, Ark., 253; Cache River, Ark., Black River, Ark. and Mo., Current River, Ark. and Mo., 254; St. Francis River, Ark., St. Francis River, Mo., 255.

In the charge of Maj. Charles J. Allen, Corps of Engineers—

Removing snags and wrecks from Mississippi River, improving Mississippi River between Ohio and Missouri rivers, 256; harbor at St. Louis, Mo., 258; Gasconade River, Mo., 259; Osage River, Mo., Kaskaskia River, Ill., 260.

In the charge of Maj. A. Mackenzie, Corps of Engineers—

Operating snag boats and dredge boats on Upper Mississippi River, 261; improving Mississippi River between Missouri River and Minneapolis, 262; Des Moines Rapids, Mississippi River, operating and care of Des Moines Rapids Canal and Dry Dock, operating and care of Galena River improvement, Ill., 263.

In the charge of Maj. W. A. Jones, Corps of Engineers—

Mississippi River above Falls of St. Anthony, Minn., reservoirs at headwaters of Mississippi River, 264; Chippewa River, including Yellow Banks, Wis., St. Croix River, Wis. and Minn., 266; Minnesota River, Minn., 267; Red River of the North, Minn. and N. Dak., 268; gauging Mississippi River at or near St. Paul, Minn., 269.

In the charge of Capt. Harry F. Hodges, Corps of Engineers—

Missouri River between the Great Falls, Mont., and Sioux City, Iowa, 270; remova of snags and other obstructions in Missouri River above Sioux City, Iowa, 271; examination of Missouri River between Three Forks and Canyon Ferry, Mont., Yellowstone River, Mont. and N. Dak., 272.

In the charge of Capt. John Biddle, Corps of Engineers—

Obion River, Tenn., Tennessee River above Chattanooga, Tenn., 273; Tennessee River below Bee Tree Shoals, Ala., 274; Hiwassee River, Tenn., 275; French Broad River, Tenn., 276; Little Pigeon River, Tenn., Clinch River, Tenn., 277; Cumberland River., Tenn. and Ky., 278; Caney Fork River, Tenn., 282.

In the charge of Capt. George W. Goethals, Corps of Engineers—

Tennessee River between Chattanooga, Tenn., and foot of Bee Tree Shoals, Ala., 282; operating and care of Muscle Shoals Canal, Tennessee River, 284.

In the charge of Lieut. Col. Amos Stickney, Corps of Engineers—

Ohio River, 285; operating snag boat on Ohio River, operating and care of Davis Island Dam, Ohio River, near Pittsburg, Pa., movable dam in Ohio River below mouth of Beaver River, Pa., movable Dam No. 2, Ohio River, 287; ice harbor at mouth of Muskingum River, Ohio, Muskingum River, Ohio, 288; operating and care of locks and dams on Muskingum River, Ohio, removing sunken vessels or craft obstructing or endangering navigation, examinations, 289.

In the charge of Capt. R. L. Hoxie, Corps of Engineers—

Monongahela River, W. Va. and Pa., 290; operating and care of Locks and Dams Nos. 8 and 9, Monongahela River, purchase of Lock and Dam No. 7, Monongahela River, purchase of Lock and Dam No. 6, Monongahela River, Cheat River, W. Va., 291; Allegheny River, Pa., dam at Herr Island, Allegheny River, near Pittsburg, Pa., 292.

In the charge of Capt. James G. Warren, Corps of Engineers—

Falls of the Ohio River, at Louisville, Ky., 293; Indiana Chute, Falls of the Ohio River, operating and care of Louisville and Portland Canal, Ky., 295; Wabash River, Ind. and Ill., 296; White River, Ind., 297.

In the charge of Col. William P. Craighill, Corps of Engineers—

Great Kanawha River, W. Va., 297; operating and care of locks and dams on Great Kanawha River, W. Va., Elk River, W. Va., 299; Gauley River, W. Va., 300; New River, Va. and W. Va., 301.

In the charge of Maj. D. W. Lockwood, Corps of Engineers—

Tradewater River, Ky., 301; Lock No. 2, Green River, at Rumsey, Ky., Green River above mouth of Big Barren River, Ky., operating and care of locks and dams on Green and Barren rivers, Ky., 302; Rough River, Ky., Kentucky River, Ky., 303; operating and care of locks and dams on Kentucky River, Ky., Licking River, Ky., between Farmers and West Liberty, 304; Big Sandy River, W. Va. and Ky., Levisa Fork of Big Sandy River, Ky., 305; Tug Fork of Big Sandy River, W. Va. and Ky., Guyandotte River, W. Va., 306; Little Kanawha River, W. Va., operating and care of lock and dam on Little Kanawha River, W. Va., 307.

LAKE RIVERS AND HARBORS.

In the charge of Maj. Clinton B. Sears, Corps of Engineers—

Harbor at Grand Marais, Minn., harbor at Agate Bay, Minn., 308; harbor at Duluth, Minn., 309; harbor at Superior Bay and St. Louis Bay, Wis., 310; harbor at Ashland, Wis., harbor at Ontonagon, Mich., 311; Eagle Harbor, Mich., waterway from Keweenaw Bay to Lake Superior, via Portage Lake and River, Mich, 312; operating and care of waterway from Keweenaw Bay to Lake Superior, via Portage Lake and River, Mich., harbor at Marquette, Mich, 313; harbor of refuge at Grand Marais, Mich, 314.

In the charge of Maj. James F. Gregory, Corps of Engineers—

Manistique Harbor, Mich., Cedar River Harbor, Mich., 315; Menominee Harbor, Mich. and Wis., Menominee River, Mich. and Wis., 316; Oconto Harbor, Wis., 317; Pensaukee Harbor, Wis., Green Bay Harbor, Wis., 318; Sturgeon Bay and Lake Michigan Ship Canal, Wis., 319; operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wis., 320; harbor of refuge at eastern entrance of Sturgeon Bay and Lake Michigan Ship Canal, Wis., Ahnapee Harbor, Wis., 321; Kewaunee Harbor, Wis., 322; Two Rivers Harbor, Wis., Manitowoc Harbor, Wis., 323; Sheboygan Harbor, Wis., 324; Port Washington Harbor, Wis., harbor of refuge at Milwaukee Bay, Wis., 325; Milwaukee Harbor, Wis., Racine Harbor, Wis., 326; Kenosha Harbor, Wis., 327; Waukegan Harbor, Ill., 328; Fox River, Wis., 329; operating and care of locks and dams on Fox River, Wis., removing sunken vessels or craft obstructing or endangering navigation, 330.

In the charge of Capt. W. L. Marshall, Corps of Engineers—

Chicago Harbor, Ill., 331; Calumet Harbor, Ill., 332; Calumet River, Ill. and Ind., 333; Illinois River, Ill., 334; operating and care of La Grange and Kampsville locks and dams, Illinois River, Ill., 335; Illinois and Mississippi Canal, Ill., 336.

In the charge of Lieut. Col. G. J. Lydecker, Corps of Engineers—

Michigan City Harbor, Ind., 337; St. Joseph Harbor, Mich., 339; St. Joseph River, Mich., 340; South Haven Harbor, Mich., Saugatuck Harbor, Mich., 341; Holland (Black Lake) Harbor, Mich., Grand Haven Harbor, Mich., 343; Muskegon Harbor, Mich., 345; White Lake Harbor, Mich., 346; Pentwater Harbor, Mich., 347; Ludington Harbor, Mich., Manistee Harbor, Mich., 348; harbor of refuge at Portage Lake, Mich., 350; Frankfort Harbor, Mich., 351; Charlevoix Harbor, Mich., 352; Petoskey Harbor, Mich., Cheboygan Harbor, Mich, 353; Alpena Harbor (Thunder Bay River), Mich., 354; Saginaw River, Mich., 355; harbor of refuge at Sand Beach, Lake Huron, Mich., 356; Black River at Port Huron, Mich., mouth of Black River, Mich., 358; Clinton River, Mich., 359; Rouge River, Mich., 360; turning basin in Rouge River, Mich., removing sunken vessels or craft obstructing or endangering navigation, 361.

In the charge of Col. O. M. Poe, Corps of Engineers—

Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo, 361; operating and care of St. Marys Falls Canal, Mich., St. Marys River at the Falls, Mich., 363; Hay Lake Channel, St. Marys River, Mich., 364; St. Clair Flats Canal, Mich., 365; operating and care of St. Clair Flats Canal, Mich., Grossepoint Channel, Mich., 366; Detroit River, Mich., 367; investigation of raft towing on the Great Lakes and their connecting waters, 368.

In the charge of Lieut. Col. Jared A. Smith, Corps of Engineers—

Monroe Harbor, Mich., 368; Toledo Harbor, Ohio, 369; Port Clinton Harbor, Ohio, 370; Sandusky Harbor, Ohio, 371; Sandusky River, Ohio, Huron Harbor, Ohio, 372; Vermillion Harbor, Ohio, 373; Black River Harbor, Ohio, 374; Cleveland Harbor, Ohio, 375; Fairport Harbor, Ohio, Ashtabula Harbor, Ohio, 376; Conneaut Harbor, Ohio, 377; removing sunken vessels or craft obstructing or endangering navigation, 378.

In the charge of Maj. E. H. Ruffner, Corps of Engineers—

Erie Harbor, Pa., 378; Presque Isle Peninsula, Erie Harbor, Pa., Dunkirk Harbor, N. Y., 379; Buffalo Harbor, N. Y., 380; Tonawanda Harbor and Niagara River, N. Y., Niagara River from Tonawanda to Port Day (Niagara Falls), N. Y., 381; Wilson Harbor, N. Y., Olcott Harbor, N. Y., 382; Oak Orchard Harbor, N. Y., 383.

In the charge of Capt. Dan C. Kingman, Corps of Engineers—

Charlotte Harbor, N. Y., 383; Pultneyville Harbor, N. Y., 384; harbor at Great Sodus Bay, N. Y., 385; harbor at Little Sodus Bay, N. Y., Oswego Harbor, N. Y., 386; harbor at Sacketts Harbor, N. Y., 388.

n the charge of Capt. Smith S. Leach, Corps of Engineers—

Shoals between Sister Islands and Cross-over Light, St. Lawrence River, N. Y., Ogdensburg Harbor, N. Y., 389; breakwater at Rouse Point, Lake Champlain, N. Y., Great Chazy River, N. Y., Plattsburg Harbor, N. Y., Burlington Harbor, Vt., 390; Otter Creek, Vt., Ticonderoga River, N. Y., 391; narrows of Lake Champlain, N. Y. and Vt., 392.

PACIFIC COAST.

In the charge of Col. G. H. Mendell, Corps of Engineers—

Oakland Harbor, Cal., 392.

In the charge of Lieut. Col. W. H. H. Benyaurd, Corps of Engineers—

Napa River, Cal., 393; Redwood Creek, Cal., San Luis Obispo Harbor, Cal., 394; Wilmington Harbor, Cal., 395; San Diego Harbor, Cal., 396; Colorado and Gila rivers at Yuma, Ariz., 397.

In the charge of Maj. W. H. Heuer, Corps of Engineers—

San Joaquin River, Cal., 398; Mokelumne River, Cal., Sacramento and Feather rivers, Cal., 399; Petaluma Creek, Cal., 400; Humboldt Harbor and Bay, Cal., 401.

In the charge of Capt. Thomas W. Symons, Corps of Engineers—

Coquille River, Oreg., 402; Coquille River, Oreg., between Coquille City and Myrtle Point, entrance to Coos Bay and Harbor, Oreg., 403; Umpqua River, Oreg., 404; mouth of Siuslaw River, Oreg., Yaquina Bay, Oreg., 405; Tillamook Bay and Bar, Oreg., 406; entrance to Nehalem Bay, Oreg., Upper Snake River, Idaho, between Huntington Bridge and Seven Devils mining district, 407; Upper Columbia and Snake rivers, Oreg. and Wash., 408; Columbia River, between head of Rock Island Rapids and foot of Priest Rapids, Wash., Willapa River and Harbor, Wash., 409; Grays Harbor and Chehalis River, Wash., 410; Chehalis River, Wash., Harbor at Olympia, Wash., 411; Swinomish Slough, Wash., Puget Sound and its tributary waters, Wash., 412.

In the charge of Maj. James C. Post, Corps of Engineers—

Mouth of Columbia River, Oreg. and Wash., 413; Columbia River, between Vancouver, Wash., and mouth of Willamette River, 414; canal at the Cascades, Columbia River, Oreg., 415; Columbia and Lower Willamette rivers below Portland, Oreg., 416; Willamette River above Portland, Oreg., Cowlitz River, Wash., 417; Youngs and Klaskuine rivers, Oreg., gauging waters of Columbia River, Oreg. and Wash., examination and plan by Board of Engineers for overcoming obstructions in Columbia River between Three Mile Rapids and Celilo Falls, Oreg. and Wash., 418.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS 419

SUPERVISION OF THE HARBOR OF NEW YORK 420

MISSISSIPPI RIVER COMMISSION 420

MISSOURI RIVER COMMISSION 421

CALIFORNIA DÉBRIS COMMISSION 421

HARBOR LINES 422

Greenport Harbor, N. Y., Patchogue River, N. Y., Harlem River, N. Y., 422; Westchester Creek, N. Y., Shrewsbury River near Sea Bright, N. J., Delaware River at Philadelphia, Pa., and Camden, N. J., Ohio River between Martins Ferry and Bellaire, Ohio, Missouri River at Kansas City, Kans., and Kansas City, Mo., Superior Bay, Wis., 423; Oconto Harbor, Wis., St. Joseph Harbor, Mich., Niagara River at Squaw Island, N. Y., San Francisco Bay and Oakland Harbor, Cal., Napa River at Napa, Cal., Everett Harbor, Wash., 424.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

(1) Bridge of Little Rock Bridge and Terminal Railway Company across Arkansas River at Little Rock, Ark., (2) bridge of St. Lawrence Railway Company across St. Lawrence River at Morristown, N. Y., (3) bridge of South St. Paul Belt Railroad Company across Mississippi River at South St. Paul, Minn., (4) bridge of Lake Shore and Michigan Southern Railroad Company across Calumet River at South Chicago, Ill., (5) bridge of Montgomery Bridge Company across Alabama River near Montgomery, Ala., (6) bridge of city of Red Wing, Minn., across Mississippi River, (7) bridge of East Liverpool Bridge Company across Ohio River at East Liverpool, Ohio, (8) bridge of Yankton Bridge Company across Missouri River at Yankton, S. Dak., 425; (9) bridge of city of Pittsburg, Pa., across Monongahela River at South Twenty-second street, (10) bridge of Wilmington and Weldon Railroad Company across Contentnia Creek near Grifton, N. C., (11) bridge of city of Tacoma, Wash., across ship channel through that city, (12) bridge of Orange County, Tex., across Cow Bayou above its confluence with Sabine River, (13) bridge of Savannah, Florida and Western Railway Company across Hillsborough River at Tampa, Fla., (14) bridges of Mobile and Dauphin Island Railroad and Harbor Company across Dog and Fowl rivers, Ala., (15) bridge of Brazoria County, Tex., across San Bernard River at Churchills Ferry, 426; (16) bridges of city of Chicago, Ill., at Van Buren street, and Metropolitan West Side Elevated Railroad Company between Jackson and Van Buren streets, across South Branch of Chicago River, Chicago, Ill., (17) bridge of Knox County, Tenn., across Holston River at Boyds Ferry near Knoxville, (18) bridge of Wisconsin Central Railroad Company across Wolf River at Gills Landing, Wis., (19) bridge of city of Kaukauna, Wis., across Fox River and Canal, (20) bridge of city of Manistee, Mich., across Manistee River at Smith street, (21) bridge of city of De Pere, Wis., across Fox River and Canal, (22) bridge of town of Hempstead, Queens County, N. Y., across Nortons Creek, 427; (23) bridge of Brazoria County, Tex., across Brazos River at Columbia, (24) bridge of Creighton Bridge Company across Allegheny River at Creighton, Pa., (25) bridge of city of Houston, Tex., across Buffalo Bayou, (26) bridge of Sea Shore Road Company across Youngs Bay, Oreg., (27) bridge of Washington and Chesapeake Beach Railway Company across Patuxent River at Mount Calvert, Md., (28) bridge of Clarke County, Wash., across East Fork of Lewis River at La Center, (29) bridge of Kensington Rapid Transit Bridge Company across Allegheny River below Tarentum, Pa., (30) bridge of Ahnapee and Western Railway Company across Sturgeon Bay, Wis., (31) bridge of city of Boston, Mass., across Chelsea Creek at Chelsea street, (32) bridge of Passaic and Bergen counties, N. J., across Passaic River at Passaic, (33) bridge of Northwestern Elevated Railroad

Company across Chicago River east of Wells street, Chicago, Ill., 428; (34) bridge of Silver Springs, Ocala and Gulf Railroad Company across Withlacoochee River at Dunnellon, Fla., (35) bridge of Port Royal and Augusta Railway Company across Savannah River near Augusta, Ga., (36) bridge of town of Kaukauna, Wis., across the lock of the Government canal at Little Chute, (37) bridge of city of Philadelphia, Pa., across Pennypack Creek at Torresdale avenue, (38) bridge of West Norfolk and Port Norfolk Drawbridge Company across Western Branch of Elizabeth River between West Norfolk and Port Norfolk, Va., (39) bridge of Kanawha County, W. Va., across Elk River at Clendennin, (40) bridge of Bristol County, Mass., across East Branch of Westport River at Westport Point, (41) bridge of Dorchester County, Md., across Cambridge Harbor at Cambridge, (42) bridge of Lake Street Elevated Railroad Company across Chicago River east of Wells street bridge, Chicago, Ill., (43) bridge of Snohomish County, Wash., across Stillaquamish River, (44) bridge of Adrien Gonsoulin across Bayou Teche near Loreauville, La., (45) bridge of Wahkiakum County, Wash., across Skamokawa Creek, 429; (46) bridge of New York Central and Hudson River Railroad Company across Spuyten Duyvil Creek, N. Y., (47) bridge of Warren County, Miss., across Big Black River at Hankinsons Ferry, (48) bridge of Mobile and Birmingham Railway Company across Three Mile Creek near Mobile, Ala., (49) bridge of Baltimore and Ohio Railroad Company across Calumet River at South Chicago, Ill., (50) bridge by Sussex County, Del., across canal between Chincoteague and Delaware bays near Henlopen City, 430.

BRIDGES OBSTRUCTING NAVIGATION.

(1) Bridge across Merrimac River between Haverhill and Bradford, Mass., 430; (2) bridge across Trent River at Newbern, N. C., (3) bridge across cove at Sullivans Island, S. C., (4) bridge across Potsburg Creek, Fla., (5) bridge across Ocklochonee River at McIntyre, Fla., 431.

OCCUPANCY OF AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS 431

MISCELLANEOUS.

WASHINGTON AQUEDUCT.

In the charge of Col. George H. Elliot, Corps of Engineers—

Washington Aqueduct, 432; increasing the water supply of Washington, D. C., 434; erection of fish ways at Great Falls, 435.

PUBLIC BUILDINGS AND GROUNDS AND WASHINGTON MONUMENT, DISTRICT OF COLUMBIA.

In the charge of Col. John M. Wilson, Lieut. Col., Corps of Engineers 435

NORTHERN AND NORTHWESTERN LAKES.

Surveys, 437; correcting engraved plates, printing and issuing of charts, resurvey of St. Marys River from Whitefish Bay to Detour light-house, 439; reexamination of St. Lawrence River, 440; estimates, water levels, 441.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES IN YELLOWSTONE NATIONAL PARK.

In the charge of Maj. William A. Jones, Corps of Engineers 441

MILITARY AND OTHER MAPS 443

RECONNAISSANCES AND EXPLORATIONS.

Officers on duty at headquarters of military departments, operations in Department of the Missouri, Department of the Columbia, Department of California, 443.

ESTIMATES FOR AMOUNTS REQUIRED FOR SURVEYS AND RECONNAISSANCES IN MILITARY DEPARTMENTS, AND FOR MAPS, INCLUSIVE OF WAR MAPS 443

OFFICE OF THE CHIEF OF ENGINEERS.

Officers in charge of divisions, 444.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

TORPEDO shed, New York Harbor, 447.

APPENDIX No. 2.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

CONSTRUCTION of gun and mortar batteries, New York Harbor, mortar battery No. 1, 449; gun-lift battery No. 1, construction of torpedo shed, New York Harbor, emplacement for 10-inch gun, 456.

APPENDIX No. 3.

REPORT OF BOARD CONCERNING SALE OF LAND IN VICINITY OF FORT MIFFLIN ON DELAWARE RIVER 461

APPENDIX No. 4.

REPORT OF COL. G. H. MENDELL, CORPS OF ENGINEERS.

CONSTRUCTION of gun and mortar batteries, San Francisco Harbor, Cal., mortar battery No. 1, 465.

APPENDIX No. 5.

REPORT OF LIEUT. COL. W. R. KING, CORPS OF ENGINEERS.

POST of Willets Point, New York Harbor, 467; United States Engineer School, 468; Battalion of Engineers, 469; Engineer depot, 474; experiments, 477; statement of funds, 478; new appropriations, estimates, 480. Appendixes: (A) programme of study and instruction for summer season, June-November, 1893, 481; (B) programme of study and instruction for winter season, December, 1893, to May, 1894, 483; (C) programme of study and instruction for summer season, June-November, 1894, 485.

RIVERS AND HARBORS, ETC.

APPENDIX A.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

IMPROVEMENTS.—St. Croix River, Me., 489; Lubec Channel, Me., 491; Moosabec Bar, Me., 492; Narraguagus River, Me., 494; breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me., 496; Bagaduce River, Me., 498; Penobscot River, Me., 499; Belfast Harbor, Me., 503; Camden Harbor, Me., 505; Rockland Harbor, Me., 506; Kennebec River, Me., 508; Harraseeket River, Me., 512; Portland Harbor, Me., 514; channel in Back Cove, Portland, Me., 517; Saco River, Me., 519; York Harbor, Me., 522; Bellamy River, N. H., 523; Cocheco River, N. H., 524; harbor of refuge at Little Harbor, N. H., 527.

APPENDIX B.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Newburyport Harbor, Mass., 529; Merrimac River, Mass., 532; Powow River, Mass., 533; Ipswich River, Mass., 534; Essex River, Mass., harbor of refuge, Sandy Bay, Cape Ann, Mass. 536; Gloucester Harbor, Mass., 539; Manchester Harbor, Mass., 542; Salem Harbor, Mass., 543; Lynn Harbor, Mass., 545; Winthrop Harbor, Mass., Mystic and Malden rivers, Mass., 547; Boston Harbor, Mass., 549; Weymouth River, Mass., 556; Hingham Harbor, Mass., 557: Scituate Harbor, Mass., 558; Plymouth Harbor, Mass., 560; Kingston Harbor, Mass., 562; Wellfleet Harbor, Mass., 563: Provincetown Harbor, Mass., 564; Chatham Harbor, Mass., 566; removing sunken vessels or craft obstructing or endangering navigation, 568.

APPENDIX C.

REPORT OF CAPT. W. H. BIXBY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor of refuge at Hyannis, Mass., 571; harbor of refuge at Nantucket, Mass., 573; Marthas Vineyard inner harbor at Edgartown, Mass., 576; harbor at Vineyard Haven, Mass., 578; Wareham Harbor, Mass., 580; New Bedford Harbor, Mass., 582; Canapitsit Channel, Mass., 584; Taunton River, Mass., 586; Pawtucket River, R. I., 587; Providence River and Narragansett Bay, R. I., 589; Green Jacket Shoal, Providence River, R. I., 592; Newport Harbor, R. I., 593; harbor of refuge at Point Judith, R. I., 596; harbor of refuge at Block Island, R. I., 597; Pawcatuck River, R. I. and Conn., 600; harbor of refuge at Stonington, Conn., 602; removing sunken vessels or craft obstructing or endangering navigation, 604.

APPENDIX D.

REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mystic River, Conn., 622; Thames River, Conn., 624; Connecticut River, Mass. and Conn., 630; harbor of refuge at Duck Island Harbor, Conn., 638; Clinton Harbor, Conn., 640; New Haven Harbor, Conn., 642; breakwaters at New Haven, Conn., 646; Milford Harbor, Conn., 650; Housatonic River, Conn., 654; Bridgeport Harbor, Conn., 659; Black Rock Harbor, Conn., 663; Saugatuck River, Conn., 667; Wilsons Point Harbor, Conn., 671; Five Mile River Harbor, Conn., 674; Stamford Harbor, Conn., 677; Harbor at Cos Cob and Mianus River, Conn., 681; Port Chester Harbor, N. Y., 683; Larchmont Harbor, N. Y., 686; East Chester Creek, N. Y., 688; Greenport Harbor, N. Y., 692; Port Jefferson Harbor, N. Y., 694; Huntington Harbor, N. Y., 698; Glen Cove Harbor, N. Y., 700; Flushing Bay, N. Y., 703; Patchogue River, N. Y., 705; Browns Creek, Sayville, N. Y., 708; removing sunken vessels or craft obstructing or endangering navigation, 711.

HARBOR LINES.—Greenport Harbor, N. Y., 716; Patchogue River, N. Y., 719.

APPENDIX E.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Hudson River, N. Y., 723; harbor at Saugerties, N. Y., 734; harbor at Rondout, N. Y., 736; Wappinger Creek, N. Y., 740; Harlem River, N. Y., 741; East River and Hell Gate, N. Y., 751; Newtown Creek, N. Y., 757; Buttermilk Channel, New York Harbor, N. Y., 761; Gowanus Bay, N. Y., 764; New York Harbor, N. Y., 770; Jamaica, Bay, N. Y., 779; Raritan Bay, N. J., 780; removing sunken vessels or craft obstructing or endangering navigation, 785.

HARBOR LINES.—Harlem River, N. Y., 786; Westchester Creek, N. Y., 790.

APPENDIX F.

REPORT OF CAPT. THOS. L. CASEY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Sumpawanus Inlet, N. Y., 794; Canarsie Bay, N. Y., 795; Sheepshead Bay, N. Y., 796; Arthur Kill, N. Y. and N. J., 798; channel between Staten Island and New Jersey, 799; Passaic River, N. J., 801; Elizabeth River, N. J., 804; Rahway River, N. J., 807; Raritan River, N. J., 808; South River, N. J., 813; Keyport Harbor, N. J., 815; Mattawan Creek, N. J., 816; Shoal Harbor and Compton Creek, N. J., 818; Shrewsbury River, N. J., 819; Manasquan (Squan) River, N. J., 822; removing sunken vessels or craft obstructing or endangering navigation, 823.

HARBOR LINES.—Shrewsbury River near Seabright, N. J., 823.

PART II.

APPENDIX G.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS.

IMPROVEMENTS.—Delaware River, N. J. and Pa., 827; harbor between Philadelphia, Pa., and Camden, N. J., 836; Schuylkill River, Pa., 846; ice harbor at Marcus Hook, Pa., 848; ice harbor at head of Delaware Bay, Del., 849; construction of iron pier in Delaware Bay, near Lewes, Del., 850; Delaware Breakwater, Del., 852; Rancocas River, N. J., 854; Alloway Creek, N. J., 855; Salem River, N. J., 857; Goshen Creek, N. J., 859; removing sunken vessels or craft obstructing or endangering navigation, 861.

HARBOR LINES.—Philadelphia Harbor, Pa., 864.

APPENDIX H.

REPORT OF WM. F. SMITH, UNITED STATES AGENT, MAJOR OF ENGINEERS, U. S. ARMY, RETIRED.

IMPROVEMENTS.—Wilmington Harbor, Del., 870; ice harbor at New Castle, Del., 873; Appoquinimink River, Del., 875; Smyrna River, Del., 876; Murderkill River, Del., 879; Mispillion River, Del., 881; Broadkiln River, Del., 883; inland waterway from Chincoteague Bay, Va., to Delaware Bay, at or near Lewes, Del., 884; Susquehanna River above and below Havre de Grace, Md., 886; Elk River, Md., Fairlee Creek, Md., 888; Chester River, Md., from Crumpton to Jones Landing, 889; Choptank River, Md., 891; LaTrappe River, Md., 892; Warwick River, Md., 894; Cambridge Harbor, Md., 895; Broad Creek River, Del., 897; Wicomico River, Md., 899; Manokin River, Md., 901; Onancock Harbor, Va., 902; harbor and approaches at Cape Charles City, Va., 904; removing sunken vessels or craft obstructing or endangering navigation, 906.

APPENDIX I.

REPORT OF COL. WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Patapsco River and channel to Baltimore, Md., 909; channel to Curtis Bay in Patapsco River, Baltimore Harbor, Md., 914; James River, Va., 915.

APPENDIX J.

REPORT OF MAJ. CHAS. E. L. B. DAVIS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Potomac River at Washington, D. C., 925; Anacostia River at Washington, D. C., 939; Occoquan Creek, Va., 941; Aquia Creek, Va., 944; Nomini Creek, Va., 948; Lower Machodoc Creek, Va., 950; Patuxent River, Md., 953; Rappahannock River, Va., 954; Urbana Creek, Va., 959; York River, Va., 961; Mattaponi River, Va., 966; Pamunkey River, Va., 968; removing sunken vessels or craft obstructing or endangering navigation, 970.

APPENDIX K.

REPORT OF CAPT. EDWARD BURR, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor of Norfolk and its approaches, Va., 973; approach to Norfolk Harbor and the United States navy-yard at Norfolk, Va., 977; Nansemond River, Va., 978; Chickahominy River, Va., 980; Appomattox River, Va., 981; inland water route from Norfolk, Va., to Albemarle Sound, N. C., through Currituck Sound, 983; North Landing River, Va., and N. C., 986; removing sunken vessels or craft obstructing or endangering navigation, 987.

APPENDIX L.

REPORT OF MAJ. W. S. STANTON, CORPS OF ENGINEERS.

IMPROVEMENTS.—Roanoke River, N. C., 989; Pasquotank River, N. C., 994; Mackey Creek, N. C., 995; Ocracoke Inlet, N. C., 996; Fishing Creek, N. C., 1018; Pamlico and Tar rivers, N. C., 1019; Contentnia Creek, N. C., 1022; Trent River, N. C., 1025; Neuse River, N. C., 1027; inland waterway between Newbern and Beaufort, N. C., 1030; harbor at Beaufort, N. C., 1031; inland waterway between Beaufort Harbor and New River, N. C., 1034; inland waterway between New River and Swansboro, N. C., New River, N. C., 1037; North East (Cape Fear) River, N. C., 1040; Black River, N. C., 1042; Cape Fear River above Wilmington, N. C., 1044; Cape Fear River at and below Wilmington, N. C., 1047; Lockwoods Folly River, N. C., 1056; Georgetown Harbor, S. C., 1057; Winyaw Bay, S. C., 1059; removing sunken vessels or craft obstructing or endangering navigation, 1065.

APPENDIX M.

REPORT OF CAPT. FREDERIC V. ABBOT, CORPS OF ENGINEERS.

IMPROVEMENTS.—Waccamaw River, N. C. and S. C., 1067; Lumber River, N. C. and S. C., 1071; Little Pedee River, S. C., 1074; Great Pedee River, S. C., 1076; Clark River, S. C., 1079; Mingo Creek, S. C., 1081; Santee River, S. C., 1084; Wateree River, S. C., 1089; Congaree River, S. C., 1092; harbor at Charleston, S. C., 1101; Ashley River, S.C., 1114; Wappoo Cut, S. C., 1116; Edisto River, S. C., 1119; Salkahatchie River, S. C., 1121; Beaufort River, S. C., 1125; removing sunken vessels or craft obstructing or endangering navigation, 1128.

APPENDIX N.

REPORT OF CAPT. O. M. CARTER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Savannah Harbor, Ga., 1129; Savannah River, Ga., 1158; Savannah River above Augusta, Ga., 1164; Darien Harbor, Ga., 1166; Altamaha River, Ga., 1169; Oconee River, Ga., 1175; Ocmulgee River, Ga., 1181; Brunswick Harbor, Ga., 1187; Brunswick Outer Bar, Ga., 1193; Jekyl Creek, Ga., 1197; Cumberland Sound, Ga., 1200; inside water route between Savannah, Ga., and Fernandina, Fla., 1206; removing sunken vessels or craft obstructing or endangering navigation, 1209.

APPENDIX O.

REPORT OF MAJ. T. H. HANDBURY, CORPS OF ENGINEERS.

IMPROVEMENTS.—St. Johns River, Fla., below Jacksonville, 1211; Upper St. Johns River, Fla., 1218; Volusia Bar, Fla., 1220; Ocklawaha River, Fla., 1221; St. Augustine Harbor, Fla., 1223; Indian River, Fla., 1225; northwest entrance, Key West Harbor, Fla., 1230; Caloosahatchee River, Fla., 1233; Charlotte Harbor and Pease Creek, Fla., 1236; Sarasota Bay, Fla., 1237; Manatee River, Fla., 1238; Tampa Bay, Fla., 1241; Withlacoochee River, Fla., 1242; harbor at Cedar Keys, Fla., 1244; Suwanee River, Fla., 1246.

APPENDIX P.

REPORT OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Apalachicola Bay, Fla., 1249; Apalachicola River, the Cut-off, and Lower Chipola River, Fla., 1252; Flint River, Ga., 1255; Chattahoochee River, Ga. and Ala., 1258; Choctawhatchee River, Fla, and Ala., 1263; harbor at Pensacola, Fla., 1268; Escambia and Conecuh rivers, Fla. and Ala., 1275; Alabama River, Ala., 1277; Coosa River, Ga. and Ala., 1285; operating and care of canals and other works of navigation on Coosa River, Ga. and Ala., 1297; Cahaba River, Ala., 1298.

APPENDIX Q.

REPORT OF MAJ. A. N. DAMRELL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mobile Harbor, Ala., 1301; Black Warrior River, Ala., from Tuscaloosa to Daniels Creek, 1310; Warrior and Tombigbee rivers, Ala., and Miss., 1311; Noxubee River, Miss., 1318; Pascagoula River, Miss., 1319; Chickasahay River, Miss , 1322; Leaf River, Miss., 1323; harbor at Biloxi Bay, Miss., 1325; Pearl River below Jackson, Miss., 1326; Pearl River between Carthage and Jackson, Miss., 1328; Pearl River between Edinburg and Carthage, Miss., 1329; Bogue Chitto, La , 1331; removing sunken vessels or craft obstructing or endangering navigation, 1332.

PART III.

APPENDIX R.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

INSPECTION of the improvement of the South Pass of the Mississippi River, 1333.

APPENDIX S.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Chefuncte River and Bogue Falia, La., 1349; Tickfaw River and its tributaries, La., 1352; Amite River and Bayou Manchac, La., 1354; Bayou Lafourche, La., 1356; Bayou Terrebonne, La., 1360; Bayou Plaquemine, Grand River, and Pigeon bayous, La., 1361; Bayou Courtableau, La., 1365; Bayou Teche, La., 1368; channel, bay, and passes of Bayou Vermillion, La., 1370; Mermentau River and tributaries, La., 1372; mouth and passes of Calcasieu River, La., 1373; harbor at Sabine Pass, Tex., 1376; Sabine River, Tex., 1379; Neches River, Tex., 1381; removing sunken vessels or craft obstructing or endangering navigation, 1383.

APPENDIX T.

REPORT OF CAPT. JOHN MILLIS, CORPS OF ENGINEERS.

IMPROVEMENT.—Securing mouth of Bayou Plaquemine, La., from further caving, 1385.

APPENDIX U.

REPORT OF MAJ. A. M. MILLER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Entrance to Galveston Harbor, Tex., 1389; ship channel in Galveston Bay, Tex., 1396; channel in West Galveston Bay, Tex., 1399; Trinity River, Tex., 1401; Cedar Bayou, Tex., 1405; Buffalo Bayou, Tex., 1409; harbor at Brazos Santiago, Tex., 1413.

APPENDIX V.

REPORT OF CAPT. J. H. WILLARD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Red River, La. and Ark., 1415; Red River above Fulton, Ark., 1452; Ouachita and Black rivers, Ark. and La., 1455; bayous D'Arbonne and Corney, La., 1468; Bayou Bartholomew, La. and Ark., 1471; Bœuf River, La., 1475; Tensas River and Bayou Maçon, La., 1479; Big Black River, Miss., 1482; Yazoo River, Miss., 1483; mouth of the Yazoo River, Miss., 1488; Tchula Lake, Miss., 1506; Tallahatchee River, Miss., 1508; Steele and Washington bayous, Miss., 1511; Big Sunflower River, Miss., 1513; Big Hatchee River, Tenn., 1516; Forked Deer River, Tenn., 1519; water gauges on Mississippi River and its principal tributaries, 1523.

APPENDIX W.

REPORT OF CAPT. CARL F. PALFREY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Removing obstructions in Arkansas River, Ark. and Kans., 1529; Arkansas River, Ark., 1531; Fourche Le Fevre River, Ark., 1544; Petit Jean River, Ark., 1546; White River, Ark., 1547; Cache River, Ark., 1554; Black River, Ark. and Mo., 1555; St. Francis River, Ark., 1557; examination at Walnut Bend, Ark., to determine the probability of the Mississippi River cutting through into St. Francis River, 1560; St. Francis River, Mo., 1564.

APPENDIX X.

REPORT OF MAJ. CHAS. J. ALLEN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Removing snags and wrecks from Mississippi River, 1567; Mississippi River between Ohio and Missouri rivers, 1577; harbor at St. Louis, Mo., 1615; Gasconade River, Mo., 1617; Osage River, Mo., 1620; Kaskaskia River, Ill., 1624.

APPENDIX Y.

REPORT OF MAJ. ALEXANDER MACKENZIE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Operating snag boats and dredge boats on Upper Mississippi Rive
1627; improvement of Mississippi River between mouth of Missouri River a
Minneapolis, 1639; Des Moines Rapids, Mississippi River, 1683; operating and ca
of Des Moines Rapids Canal and Dry Dock, 1684; operating and care of Gale
River improvement, Ill., 1691.

APPENDIX Z.

REPORT OF MAJ. W. A. JONES, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mississippi River above Falls of St. Anthony, Minn., 1693;
voirs at headwaters of Mississippi River, 1696; Chippewa River, including
Banks, Wis., 1718; St. Croix River, Wis. and Minn., 1721; Minnesota River.
1725; Red River of the North, Minn. and N. Dak., 1728; gauging Mississip
at or near St. Paul, Minn., 1732; surveys for reservoirs at sources of Mi
St. Croix, Chippewa, and Wisconsin rivers, 1736.

APPENDIX A A.

REPORT OF CAPT. H. F. HODGES, CORPS OF ENGINEERS.

IMPROVEMENTS.—Missouri River between the Great Falls, Montana, and Sioux City, Iowa, 1739; removal of snags and other obstructions in Missouri River above Sioux City, Iowa, 1772; examination of Missouri River between Three Forks and Canyon Ferry, Mont., to determine availability of water power, 1775; Yellowstone River, Mont. and N. Dak., 1784.

APPENDIX B B.

REPORT OF CAPT. JOHN BIDDLE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Obion River, Tenn., 1785; Tennessee River above Chattanooga and below Bee Tree Shoals, 1787; Hiwassee River, Tenn., 1795; French Broad and Little Pigeon rivers, Tenn., 1797; Clinch River, Tenn., 1801; Cumberland River, Tenn. and Ky., 1804; Caney Fork River, Tenn., 1818.

APPENDIX C C.

REPORT OF CAPT. GEO. W. GOETHALS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tennessee River between Chattanooga, Tenn., and foot of Bee Tree Shoals, Ala., 1821; operating and care of Muscle Shoals Canal, Tennessee River, 1828.

APPENDIX D D.

REPORT OF LIEUT. COL. AMOS STICKNEY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Ohio River, 1836; operating snag boat on Ohio River, 1864; operating and care of Davis Island Dam, Ohio River, near Pittsburg, Pa., 1867; movable dam in Ohio River below mouth of Beaver River, Pa., 1870; ice harbor at mouth of Muskingum River, Ohio, 1874; Muskingum River, Ohio, 1875; operating and care of locks and dams on Muskingum River, Ohio, 1876; removing sunken vessels or craft obstructing or endangering navigation, 1889.
EXAMINATION.—Mouth of Crawfish Creek and mouth of Mill Creek, for ice harbors at Cincinnati, Ohio, 1890.
HARBOR LINES.—Ohio River from Martins Ferry to Bellaire, Ohio, 1894.

APPENDIX E E.

REPORT OF CAPT. R. L. HOXIE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Monongahela River, W. Va. and Pa., 1903; operating and care of locks and dams Nos. 8 and 9, Monongahela River, 1908; purchase of Lock and Dam No. 7, Monongahela River, purchase of Lock and Dam No. 6, Monongahela River, Cheat River, W. Va., 1911; Allegheny River, Pa., 1913; dam at Herr Island, Allegheny River, near Pittsburg, Pa., 1918.

APPENDIX F F.

REPORT OF CAPT. J. G. WARREN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Falls of the Ohio River at Louisville, Ky., 1929; Indiana Chute, Falls of the Ohio River, 1933; operating and care of Louisville and Portland Canal, Ky., 1935; Wabash River, Ind. and Ill., 1942; White River, Ind., 1948.

APPENDIX G G.

REPORT OF COL. WM. P. CRAIGHILL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Great Kanawha River, W. Va., 1951; operating and care of locks and dams on Great Kanawha River, W. Va., 1962; Elk River, W. Va., 1963; Gauley River, W. Va., 1964; New River, Va. and W. Va., 1965.

APPENDIX H H.

REPORT OF MAJ. D. W. LOCKWOOD, CORPS OF ENGINEERS.

Improvements.—Tradewater River, Ky., 1967; reconstruction of Lock No. 2, Green River, at Rumsey, Ky., 1968; Green River, above mouth of Big Barren River, Ky. (Lock No. 5), 1971; operating and care of locks and dams on Green and Barren rivers, Ky., 1972; Rough River, Ky., 1978; Kentucky River, Ky., 1980; operating and care of locks and dams on Kentucky River, Ky., 1983; Licking River, between Farmers and West Liberty, Ky., Big Sandy River, W. Va. and Ky., 1992; Levisa Fork of Big Sandy River, Ky., 2001; Tug Fork of Big Sandy River, W. Va. and Ky., 2002; Guyandotte River, W. Va., 2004; Little Kanawha River, W. Va., 2006; operating and care of lock on Little Kanawha River, W. Va., 2007.

PART IV.

APPENDIX I I.

REPORT OF MAJ. CLINTON B. SEARS, CORPS OF ENGINEERS.

Improvements.—Harbor at Grand Marais, Minn., 2009; harbor at Agate Bay, Minn., 2011; harbor at Duluth, Minn., 2014; harbor at Superior Bay and St. Louis Bay, Wis., 2019; harbor at Ashland, Wis., 2023; harbor at Ontonagon, Mich., 2026; Eagle Harbor, Mich., 2028; waterway from Keweenaw Bay to Lake Superior, Mich., 2029; harbor at Marquette, Mich., 2035; harbor of refuge at Grand Marais, Mich., 2037.

Harbor Lines.—Superior Bay, Wis., 2039.

APPENDIX J J.

REPORT OF MAJ. JAMES F. GREGORY, CORPS OF ENGINEERS.

Improvements.—Manistique Harbor, Mich., 2042; Cedar River Harbor, Mich., 2043; Menominee Harbor, Mich. and Wis., 2045; Menominee River, Mich. and Wis., 2047; Oconto Harbor, Wis., 2049; Pensaukee Harbor, Wis., 2052; Green Bay Harbor, Wis., 2053; Sturgeon Bay and Lake Michigan Canal, Wis., 2056; operating and care of Sturgeon Bay and Lake Michigan Canal, Wis., 2058; harbor of refuge at entrance of Sturgeon Bay and Lake Michigan Canal, Wis., 2062; Ahnapee Harbor, Wis., 2064; Kewaunee Harbor, Wis., 2066; Two Rivers Harbor, Wis., 2069; Manitowoc Harbor, Wis., 2072; Sheboygan Harbor, Wis., 2075; Port Washington Harbor, Wis., 2079; harbor of refuge at Milwaukee Bay, Wis., 2081; Milwaukee Harbor, Wis., 2091; Racine Harbor, Wis., 2094; Kenosha Harbor, Wis., 2097; Waukegan Harbor, Ill., 2100; Fox River, Wis., 2103; operating and care of locks and dams on Fox River, Wis., 2111; removing sunken vessels or craft obstructing or endangering navigation, 2124.

Harbor Lines.—Oconto Harbor, Wis., 2124.

APPENDIX K K.

REPORT OF CAPT. W. L. MARSHALL, CORPS OF ENGINEERS.

Improvements.—Chicago Harbor, Ill., 2127; Calumet Harbor, Ill., 2138; Calumet River, Ill. and Ind., 2143; Illinois River, Ill., 2150; operating and care of La Grange and Kampsville locks and dams, Illinois River, Ill., 2159; Illinois and Mississippi Canal, Ill., 2162.

APPENDIX L L.

REPORT OF LIEUT. COL. G. J. LYDECKER, CORPS OF ENGINEERS.

Improvements.—Michigan City Harbor, Ind., 2188; St. Joseph Harbor, Mich., 2192; St. Joseph River, Mich., 2197; South Haven Harbor, Mich., 2198; Saugatuck Harbor, Mich., 2201; Holland (Black Lake) Harbor, Mich., 2206; Grand Haven Harbor, Mich., 2208; Muskegon Harbor, Mich., 2211; White Lake Harbor, Mich., 2215; Pentwater Harbor, Mich., 2218; Ludington Harbor, Mich., 2220; Manistee Harbor, Mich., 2223; harbor of refuge at Portage Lake, Manistee County, Mich., 2228; Frankfort Harbor, Mich., 2230; Charlevoix Harbor, Mich., 2233; Petoskey Harbor, Mich., 2235; Cheboygan Harbor, Mich., 2239; Alpena Harbor, Mich., 2241; Saginaw River, Mich., 2243; harbor of refuge at Sand Beach, Lake Huron, Mich., 2247; Black River at Port Huron, Mich., 2251; mouth of Black River, Mich., 2253; Clinton River, Mich., 2254; Rouge River, Mich., 2255; turning basin in Rouge River, Mich., removing sunken vessels or craft obstructing or endangering navigation, 2257.

Harbor Lines.—Saint Joseph Harbor, Mich., 2258.

APPENDIX M M.

REPORT OF COL. O. M. POE, CORPS OF ENGINEERS.

Improvements.—Ship channel connecting the waters of the Great Lakes, between Chicago, Duluth, and Buffalo, 2261; operating and care of St. Marys Falls Canal, Mich., 2267; St. Marys River at the Falls, Mich., 2287; Hay Lake Channel, St. Marys River, Mich., 2367; St. Clair Flats Canal, Mich., 2371; operating and care of St. Clair Flats Canal, Mich., 2373; Grossepoint Channel, Mich., Detroit River, Mich., 2376; investigation of raft towing on the Great Lakes and their connecting waters, 2378.

APPENDIX N N.

REPORT OF LIEUT. COL. JARED A. SMITH, CORPS OF ENGINEERS.

Improvements.—Monroe Harbor, Mich., 2383; Toledo Harbor, Ohio, 2385; Port Clinton Harbor, Ohio, 2394; Sandusky Harbor, Ohio, 2396; Sandusky River, Ohio, 2398; Huron Harbor, Ohio, 2400; Vermillion Harbor, Ohio, 2403; Black River Harbor, Ohio, 2405; Cleveland Harbor, Ohio, 2409; Fairport Harbor, Ohio, 2414; Ashtabula Harbor, Ohio, 2420; Conneaut Harbor, Ohio, 2423; removing sunken vessels or craft obstructing or endangering navigation, 2426.

APPENDIX O O.

REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

Improvements.—Erie Harbor, Pa., 2427; Presque Isle Peninsula, Erie Harbor, Pa., 2433; Dunkirk Harbor, N. Y., 2434; Buffalo Harbor, N. Y., 2438; Tonawanda Harbor and Niagara River, N. Y., 2444; Niagara River from Tonawanda to Port Day, N. Y., 2447; Wilson Harbor, N. Y., 2448; Olcott Harbor, N. Y., 2450; Oak Orchard Harbor, N. Y., 2451.
Harbor Lines.—Niagara River at Squaw Island, N. Y., 2452.

APPENDIX P P.

REPORT OF CAPT. DAN C. KINGMAN, CORPS OF ENGINEERS.

Improvements.—Harbor at Charlotte, N. Y., 2455; harbor at Pultneyville, N. Y., 2460; harbor at Great Sodus Bay, N. Y., 2464; harbor at Little Sodus Bay, N. Y., 2470; harbor at Oswego, N. Y., 2476; harbor at Sacketts Harbor, N. Y., 2486.

APPENDIX Q Q.

REPORT OF CAPT. SMITH S. LEACH, CORPS OF ENGINEERS.

Improvements.—Shoals between Sister Islands and Cross-over Light, St. Lawrence River, N. Y., 2489; Ogdensburg Harbor, N. Y., 2491; breakwater at Rouse Point, Lake Champlain, N. Y., 2492; Great.Chazy River, N. Y., 2493; Plattsburg Harbor, N. Y., 2495; Burlington Harbor, Vt., 2496; Otter Creek, Vt., 2497; Ticonderoga River, N. Y., 2498; Narrows of Lake Champlain, N. Y. and Vt., 2499.

APPENDIX R R.

REPORT OF COL. G. H. MENDELL, CORPS OF ENGINEERS.

Improvement.—Oakland Harbor, Cal., 2501.
Harbor Lines.—San Francisco Bay from Point San Pablo southward, in front of Oakland and Alameda, Cal., 2505; Oakland Harbor, Cal., 2506.

APPENDIX S S.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

Improvements.—Napa River, Cal., 2507; Redwood Creek, Cal., San Luis Obispo Harbor, Cal., 2509; Wilmington Harbor Cal., 2511; San Diego Harbor, Cal., 2514; Colorado and Gila rivers, at Yuma, Ariz., 2521.
Harbor Lines.—Napa River at Napa, Cal., 2522.

APPENDIX T T.

REPORT OF MAJ. W. H. HEUER, CORPS OF ENGINEERS.

Improvements.—San Joaquin River, Cal., 2527; Mokelumne River, Cal., 2531; Sacramento and Feather rivers, Cal., 2533; Petaluma Creek, Cal., 2538; Humboldt Harbor and Bay, Cal., 2540.

APPENDIX U U.

REPORT OF CAPT. THOMAS W. SYMONS, CORPS OF ENGINEERS.

Improvements.—Coquille River, Oreg., 2553; Coquille River, Oreg., between Coquille City and Myrtle Point, 2558; entrance to Coos Bay and Harbor, Oreg., 2561; Umpqua River, Oreg., 2569; mouth of Siuslaw River, Oreg., 2573; Yaquina Bay, Oreg., 2576; Tillamook Bay and Bar, Oreg., 2585; entrance to Nehalem Bay, Oreg., 2588; Upper Snake River, Idaho, between Huntington Bridge and Seven Devils mining district, 2589; Upper Columbia and Snake rivers, Oreg. and Wash., 2590; Columbia River, between head of Rock Island Rapids and foot of Priest Rapids, Wash , 2593; Willapa River and Harbor, Wash., 2595; Grays Harbor and Chehalis River, Wash., 2597; Chehalis River, Wash., 2604; harbor at Olympia, Wash., 2606; Swinomish Slough, Wash., 2611; Puget Sound and its tributary waters, Wash., 2619; Everett Harbor, Wash., 2623.

Harbor Lines.—Everett Harbor, Wash., 2627.

APPENDIX V V.

REPORT OF MAJ. JAMES C. POST, CORPS OF ENGINEERS.

Improvements.—Mouth of Columbia River, Oreg. and Wash., 2631; Columbia River between Vancouver, Wash., and mouth of Willamette River, 2643; canal at the Cascades, Columbia River, Oreg., 2645; Columbia and Lower Willamette rivers below Portland, Oreg., 2654; Willamette River above Portland, 2659; Yamhill River, Oreg., 2661; Cowlitz River, Wash., 2662; Youngs and Klasquine rivers, Oreg , 2663; gauging waters of Columbia River, Oreg. and Wash., Columbia River between Three Mile Rapids and Celilo Falls, Oreg., 2664.

APPENDIX W W.

REPORT OF LIEUT. COMMANDER DANIEL DELEHANTY, UNITED STATES NAVY.

Supervision of the harbor of New York, 2681.

PART V.

APPENDIX X X.

REPORT OF THE MISSISSIPPI RIVER COMMISSION.

C. B. Comstock, colonel, Corps of Engineers, bvt. brig. gen., U. S. A., president; Charles R. Suter, lieutenant-colonel, Corps of Engineers, U. S. A.; Amos Stickney, lieutenant-colonel, Corps of Engineers, U. S. A.; Henry L. Whiting, assistant U. S. Coast and Geodetic Survey; B. M. Harrod, Robert S. Taylor, and Henry Flad, *commissioners*.

Annual Report for Fiscal Year ending June 30, 1894, 2697.

Appendix 1.—Report of First Lieut. Geo. A. Zinn, Corps of Engineers, secretary, Mississippi River Commission, 2717; (A) report of Assistant Engineer J. A. Ockerson on field work and office reduction, 2727; (B) report of Assistant Engineer A. T. Morrow on secondary triangulation field work from Gordons Ferry, Iowa, to Prairie Du Chien, Wis., 2797; (C) report of Assistant Engineer A. T. Morrow on topographical and hydrographical field work from near Montrose, Iowa, to Keithsburg, Ill., 2798; (D) report of Assistant Engineer A. T. Morrow on topographical and hydrographical field work from Head of Passes to Donaldsonville, La., 2800; (E) tables of highest and lowest stages since 1872, 2804; (F) field reports on discharge measurements and report of Assistant Engineer Kivas Tully on reductions of the same, with "Low-water Board" observations of 1879, 2808.

APPENDIX 2.—Report of Capt. S. W. Roessler, Corps of Engineers, upon operations in the First and Second districts, 2859; (A) report of Assistant Engineer William Gerig on improvement of harbor of New Madrid, Mo., 2878; (B) report of Assistant Engineer Aug. J. Nolty on operations at Plum Point Reach, 2881; (C) report of Assistant Engineer Charles Le Vasseur on construction of dam across Elmot Chute, near Gold Dust, Tenn., 2890; (D) report of Assistant Engineer E. L. Cooley on revetment of Bullerton Tow-head, Ark., 2897; (E) report of Assistant Engineer William Gerig on improvement at Hopefield Bend, Ark., 2904; (F) report of Assistant Engineer William M. Rees on repairs to plant, 2910.

APPENDIX 3.—Report of Capt. C. McD. Townsend, Corps of Engineers, upon operations in Third district, 2919; (A) report of Assistant Engineer Arthur Hider upon repairs to revetment, 2931; (B) report of Assistant Engineer H. St. L. Coppée on survey of Vicksburg Harbor, Miss., 2944; (C) report of Assistant Engineer Arthur Hider on surveys, 2945; (D) statement by Assistant Engineer Arthur Hider on repairs to plant, Third district, May 1, 1893, to April 30, 1894, 2954; (E) cost of levees in Third district, from 1882 to May 31, 1894, 2956; (F) investigations by Capt. C. McD. Townsend, Corps of Engineers, of gauge relations in Third district and above it, 2967.

APPENDIX 4.—Report of Capt. John Millis, Corps of Engineers, upon operations in the Fourth district, 2974; (A) report of Captain Millis on surveys in vicinity of crevasses, 3064.

PART VI.

APPENDIX Y Y.

REPORT OF THE MISSOURI RIVER COMMISSION.

CHARLES R. SUTER, lieutenant-colonel, Corps of Engineers, U. S. A., president; A. MACKENZIE, major, Corps of Engineers, U. S. A.; CHAS. J. ALLEN, major, Corps of Engineers, U. S. A.; GARLAND C. BROADHEAD and RICHARD S. BERLIN, *commissioners*.

ANNUAL REPORT FOR FISCAL YEAR ENDING JUNE 30, 1894, 3075.

APPENDIX A.—Annual report of Second Lieut. James F. McIndoe, Corps of Engineers, secretary Missouri River Commission, 3083; (1) annual report of Mr. O. B. Wheeler, assistant engineer, 3085; (2) annual report of Mr. O. H. B. Turner, assistant engineer, 3089; (3) report on measurement of bridges, and (4) annual report of Mr. A. H. Blaisdell, assistant engineer, 3108; (5) report on results of rock borings in Missouri River valley, 3111; (6) annual report of Mr. J. A. Seddon, assistant engineer, 3112; (7) index of surveys and physica ldata in annual reports of the Commission from 1885 to 1893, 3113; (8) report on commerce of Missouri River during calendar year 1893, 3116.

APPENDIX B.—Annual report of Mr. S. Waters Fox, division engineer, Omaha division, 3125.

APPENDIX C.—Annual report of Mr. S. Waters Fox, division engineer, St. Joseph division, 3128.

APPENDIX D.—Annual report of Mr. S. Waters Fox, division engineer, Kansas City division, 3130.

APPENDIX E.—Annual report of Mr. Samuel H. Yonge, division engineer, Osage division, 3130.

APPENDIX F.—Annual report of Mr. S. Waters Fox, division engineer, Gasconade division, 3152.

APPENDIX G.—Establishment of harbor lines in Missouri River at Kansas City, Kans., and Kansas City, Mo., 3159.

APPENDIX Z Z.

REPORT OF THE CALIFORNIA DÉBRIS COMMISSION.

G. H. MENDELL, colonel, Corps of Engineers, U. S. A., president; W. H. H. BENYAURD, lieutenant-colonel, Corps of Engineers, U. S. A., and W. H. HEUER, major, Corps of Engineers, U. S. A., *commissioners*.

ANNUAL REPORT FOR YEAR ENDING NOVEMBER 15, 1893, 3169.

APPENDIX A.—Rules and instructions, 3176.

APPENDIX B.—Table showing applications to mine by the hydraulic process, 3178.

APPENDIX C.—Judicial decisions, 3180.

APPENDIX D.—Act of legislature of California providing for a State débris commissioner, 3183.

APPENDIX E.—Act of Congress creating the California Débris Commission, 3184.

APPENDIX A A A.

OCCUPANCY OF AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS.

(1) Report of Col. Wm. P. Craighill, Corps of Engineers, 3189; (2) report of Capt. O. M. Carter, Corps of Engineers, 3190; (3) report of Col. O. M. Poe, Corps of Engineers, 3190; (4) report of Capt. T. W. Symons, Corps of Engineers, 3192.

APPENDIX B B B.

REPORT OF COL. GEORGE H. ELLIOT, CORPS OF ENGINEERS.

Washington Aqueduct, 3193; increasing the water supply of Washington, D. C., 3222; erection of fishways at Great Falls, 3224; use of water power of Great Falls of the Potomac River for electric lighting, 3256.

APPENDIX C C C.

REPORT OF COL. JOHN M. WILSON, UNITED STATES ARMY.

Improvement and care of public buildings and grounds in the District of Columbia, 3265; Washington Monument, 3267.

APPENDIX D D D.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES.

Surveys, correcting engraved plates, printing and issuing charts, 3315; resurvey of St. Marys River, 3317; reports of assistants on resurvey of St. Marys River, viz: Lieut. Charles S. Riché, Corps of Engineers, 3321; (A) Mr. Thomas Russell, 3329; (B) Mr. Fred Morley, 3397; (C) Mr. E. E. Haskell, assistant engineer, 3403; (D) Mr. Glen E. Balch, assistant engineer, 3404; (E) Mr. E. E. Haskell, assistant engineer, 3409; (F) Mr. H. Von Schon, assistant engineer, 3419; (G) Mr. David Molitor, assistant engineer, 3422; (H) Mr. E. E. Haskell, assistant engineer, 3426. Reexamination of St. Lawrence River, 3428; annual water levels, 3319, 3430.

APPENDIX E E E.

REPORT OF MAJ. WILLIAM A. JONES, CORPS OF ENGINEERS.

Construction and improvement of roads and bridges in the Yellowstone National Park, 3439.

APPENDIX F F F.

EXPLORATIONS AND SURVEYS IN MILITARY DEPARTMENTS.

Report of Capt. William L. Marshall, Corps of Engineers, engineer officer on operations in Department of the Missouri, 3451; report of Major Tully McCrea, Fifth Artillery, acting engineer officer, on operations in Department of the Columbia, 3452; report of Lieut. Charles G. Lyman, Second Cavalry, in charge of office, on operations in Department of California, 3453.

LAWS AFFECTING THE CORPS OF ENGINEERS, FIFTY-THIRD CONGRESS, SECOND SESSION, 1893-'94 3455

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

(CONTINUED.)

APPENDIX G.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, OF DELAWARE RIVER AND BAY, AND OF WATERS TRIBUTARY THERETO, NEW JERSEY, PENNSYLVANIA, AND DELAWARE.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Delaware River, New Jersey and Pennsylvania.
2. Harbor between Philadelphia, Pa., and Camden, N. J.
3. Schuylkill River, Pennsylvania.
4. Ice harbor at Marcus Hook, Pennsylvania.
5. Ice harbor at head of Delaware Bay, Delaware.
6. Construction of iron pier in Delaware Bay, near Lewes, Del.
7. Delaware Breakwater, Delaware.
8. Rancocas River, New Jersey.
9. Alloway Creek, New Jersey.
10. Salem River, New Jersey.
11. Goshen Creek, New Jersey.
12. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

13. Philadelphia Harbor, Pennsylvania.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 7, 1894.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1894.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

G 1.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

The project for this improvement, from Philadelphia to the sea, is based upon the report of a Board of Engineers, dated January 23, 1885, and published in the Annual Report of the Chief of Engineers for 1885.

It provides for the formation of a permanent channel 26 feet deep at mean low water and 600 feet wide at all points where a less depth and width exist between deep water in Delaware Bay and a point about midway between the American Shipbuilding Company's yard and the Gas Trust Wharf, in the city of Philadelphia, by diking, dredging, and rock removal.

The project for the improvement of the river between Trenton and Bridesburg was approved February 28, 1890, and is published in the Annual Report of the Chief of Engineers for 1890. It provides for the formation of a channel 12 feet deep at mean low water over Kinkora Bar by the construction of a dike and dredging.

Expenditures during the past fiscal year have been applied to the following operations:

1. Examinations and surveys at Kinkora Bar, Five Mile Bar, and Schooner Ledge.
2. Improvement and examination of Mifflin Bar.
3. Improvement and examination of Cherry Island Flats.
4. Improvement and survey of Bulkhead Bar.

These operations will be described in the above order.

1. EXAMINATIONS AND SURVEYS.

Kinkora Bar.—This locality is situated in the reach of river between Trenton, N. J., and Bridesburg, Pa., and about 25 miles above the foot of Market street, Philadelphia. In its natural condition Kinkora Bar carried a ruling depth of 7½ feet at mean low water and formed the only obstruction to a 12-foot low-water channel as far up river as Whitehill, or to within 5 miles of Trenton.

During the year 1890 a dike was built partly closing the slough south of Newbold Island, and a channel with a depth of 12 feet at mean low water and a width of about 175 feet was dredged across the bar, as provided in the project of 1890. The dike was repaired in 1892.

This improvement has not proved permanent. At the close of the fiscal year ending June 30, 1893, the channel had shoaled the minimum low-water depth across the bar being about 7½ feet. From an examination made at the close of the past fiscal year it appears that the minimum depth at mean low water across the bar is 7½ feet.

This part of the river is exposed to the vigorous action of ice and freshets, and the channel dimensions are constantly changing. Its permanent improvement at a reasonable cost is therefore considered impracticable.

Five Mile Bar.—This obstruction lies directly above the upper end of Petty Island, in the port of Philadelphia. The works existing for its improvement consist of a dike extending from the New Jersey shore at Fishers Point to within 2,000 feet of the head of Petty Island. At the close of the fiscal year ending June 30, 1890, the dike had reached an extension of 4,500 linear feet, of which the upper 3,500 linear feet consisted of a random stone dike founded upon a brush mattress sill and backed with gravel and bowlders derived from the excavation of the channel at Port Richmond, and the lower 1,000 linear feet of a pile dike filled with stone. The tops of these constructions were carried to a height of 2 feet above mean high water. This dike has not been extended during the past three years.

At the close of the fiscal year ending June 30, 1893, the action of the dike had formed a channel 12 to 15 feet deep and 200 feet wide across the bar. An examination made in June, 1894, shows that there is now a channel from 13 to 15 feet deep and 270 feet wide across the bar, that the flood channel north of the bar continues to move upstream, and that the ebb channel south of the bar has changed very little.

Schooner Ledge.—At a point about 18 miles below Philadelphia the main ship channel was originally obstructed by a ledge of rock known as Schooner Ledge, which reduced the depth at mean low water to about 18 feet.

In 1879 the formation of a channel was commenced through this obstruction and continued until 1884, when a channel was reported as formed to a depth of 24 feet at mean low water for a width of 330 feet. Subsequently other obstructions were discovered, and in 1889, 250 cubic yards of sand and rock were removed from the shoal area. In the same year a detailed survey was made to determine the exact condition of the channel, but owing to the difficulty of finding with certainty isolated points with the lead some obstructions remained undiscovered.

On February 20, 1893, the German tank steamship *Elsie Marie*, drawing about 24½ feet aft, grounded in this locality on the range, at or near high-water slack, indicating unknown obstructions in the channel. At the request of the board of port wardens of Philadelphia the channel was carefully examined by sweeping, and the location and character of the obstructions were determined by a diver during May, 1893.

These examinations showed that the obstructions consisted of broken rock or bowlders, some of which may be lost buoy sinkers, and three points of a solid ledge over which the minimum depth is 22½ feet at mean low water. As these hard obstructions are very dangerous to navigation, a closer examination was made between August and October, 1893, to determine the amount of rock above the plane of 27 feet below mean low water, within the limits of the 600-foot channel projected by the Board of Engineers January 23, 1885. This examination shows that the present channel has a depth of 24 feet at mean low water and a minimum width of 220 feet. A project for the removal of the rock will be submitted as soon as possible.

2. IMPROVEMENT AND EXAMINATION OF MIFFLIN BAR.

This obstruction lies about 10 miles below Philadelphia. The existing works for its improvement consist of a random stone dike upon a brush-mattress foundation extending from the Pennsylvania shore, at Hog Island, to the head of Maiden Island, a distance of 7,200 feet. The object of the dike is the improvement of the main ship channel over Mifflin Bar by the concentration of the tidal currents. The dike was commenced in 1885 and completed to the height of mean low water in September, 1888. Since that date no additions have been made to the work.

At the close of the fiscal year ending June 30, 1893, the channel across the bar, dredged in 1888, carried a mean low-water depth of 24 feet over a width of 150 feet. An examination made in May, 1894, shows that the channel has a least depth of 24.6 feet at mean low water across the bar. The 24-foot channel has now a minimum width of 100 feet.

Under date of May 9, 1894, a contract was entered into with The Brandywine Granite Company, of Wilmington, Del., for the reconstruction and repair of a part of the dike. Work under this contract, which consists in the raising of a part of the present dike to the height of 8 feet above mean low water, is now in progress, and it is believed will result in giving the channel reasonable permanency.

3. IMPROVEMENT AND EXAMINATION OF CHERRY ISLAND FLATS.

These flats are situated about 24 miles below Philadelphia and just above the mouth of the Christiana River. They lie in midstream, separating two channels, neither of which had originally sufficient depth for the purposes of commerce. The western channel had an average low-water depth of about 19 feet.

The formation of a channel west of the flats, having a width of about 470 feet and a depth of 24 feet at mean low water, was commenced in 1879 and completed in 1884, the length of the cut being nearly 2 miles. In this work 1,594,740 cubic yards of material were removed by dredging, at a cost of $400,000.

The general project for the improvement of the river provides for the widening of this channel to 600 feet and an increase of depth to 26 feet at mean low water. Frequent examinations since 1884 show that the cut shoals very slowly, so that it is more economical to maintain it by dredging at long intervals than by the construction of dikes. An examination made during May, 1892, showed that the channel had shoaled about 1.2 feet over a distance of about 10,000 feet.

A project for continuing the improvement of the channel in this locality was submitted on July 15, 1892, and approved on July 20, 1892. It provides for the formation of a channel 26 feet deep at mean low water with a width of 500 feet, at an estimated cost of $100,000.

Under date of September 6, 1892, contract for the execution of this work was entered into with the American Dredging Company, of Philadelphia. Work under this contract was commenced on September 19, 1892, and was completed on October 29, 1893. The channel was dredged 400 feet wide and to a depth of from 25 to 27 feet at mean low water. The aggregate amount of material removed was 960,462 cubic yards, scow measurement. This material was deposited in shallow water on the east side of the flats in order to reduce the cross section at this point.

An examination made in November, 1893, showed shoaling in the lower part of the cut. The depths at that time ranged from 19 to 21 feet at mean low water over the width dredged, for a distance of about 4,000 feet, but the material was very soft.

4. IMPROVEMENT AND SURVEY OF BULKHEAD BAR.

This locality is situated about 36 miles below Philadelphia or about 3 miles above Fort Delaware. In its unimproved condition the shoal carried from 20 to 21 feet at mean low water, and although the channel across the bar had been repeatedly deepened by dredging it soon returned to its original condition, and formed the most marked obstruction to commerce in the navigation of the river between Philadelphia and the sea.

The project of the Board of Engineers of 1884 for the improvement of this locality proposed the construction of a random stone dike, about 14,000 feet in length, brought to the height of mean low water and extending along the easterly side of Bulkhead Shoal, from the upper end of Pea Patch Island, upstream, in a curved line approximately parallel to the New Jersey shore opposite.

For reasons given in the Annual Report of the Chief of Engineers for 1890, p. 872, a project was submitted and approved May 15, 1890, in which pile dikes filled with stone were substituted for the previously proposed random stone dikes, and east and west dikes in place of the single dike along the west side of the channel.

The east dike was commenced on August 25, 1890, and completed on June 30, 1892. Its total length, including the shore extension, was 4,063 feet. In 1891 and 1892, 51,810 cubic yards of material were removed from the channel by dredging.

During the fiscal year ending June 30, 1893, the exposed end of the dike was strengthened and repaired by depositing large stone in the head and around its base. Two breaks in the dike, caused by an unknown vessel running into it, were repaired. At the close of the fiscal year 1893 there was a channel across the bar having a minimum depth of 24 feet at mean low water, with a least width of 340 feet, and a minimum depth of 26 feet at mean low water, with a least width of about 100 feet. The flood channel on the west side of the bar had not advanced any further upstream. An examination made in November, 1893, showed that the channel had shoaled opposite the shore end of the dike to less than 26 feet at mean low water for a distance of about 1,200 feet, the least depth being 25.1 feet. The channel having a minimum depth of 24 feet at mean low water had a least width of 350 feet. The flood channel on the west side of the bar had not advanced upstream. The Bulkhead Shoal has advanced upstream and toward the channel.

During the past fiscal year the end of the dike forced out of position by the ice in January, 1893, was repaired and strengthened, under contract with The Brandywine Granite Company, at a total cost of $5,753.97. While the condition of this locality is very satisfactory, the permanency of the improvement can not yet be considered as fully established.

The U. S. cruiser *Columbia* having been injured by striking some hard substance supposed to be in the vicinity of Bulkhead Bar in the Delaware River, an examination of the channel in this locality was made on June 21, 1894. The channel was thoroughly swept and was found to be free from any kind of obstruction.

OBSTRUCTIONS IN FRONT OF LEAGUE ISLAND.

Under date of February 2, 1894, the sum of $5,000 was allotted from the appropriation for improving Delaware River, Pennsylvania and New Jersey, for the removal of a certain plant left in the waterway along the front of League Island by the former contractors for the improvement of the harbor of Philadelphia, and which formed serious obstructions to operations by the present contractors. The bids received for removal of the plant were rejected by authority of the Department dated April 13, 1894, a large part of the plant having been removed by parties interested.

The Delaware River is tributary to the following collection districts: Trenton, Philadelphia, Wilmington, and Bridgeton.

The amount of revenue collected in these districts during the year ending December 31, 1893, was $9,912,120.58.

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	$15,000	March 3, 1881	$250,000
June 10, 1872	10,000	August 2, 1882	286,000
March 3, 1873	115,000	July 5, 1884	200,000
June 23, 1874	60,000	August 5, 1886	210,000
March 3, 1875	30,000	August 11, 1888	250,000
August 14, 1876	40,000	September 19, 1890	240,000
June 18, 1878	110,000	July 13, 1892	50,000
March 3, 1879	201,000		
June 14, 1880	235,000	Total	2,302,000

Total amount appropriated on present project to June 30, 1894 .... $950,000

EXPENDITURES.

Total to June 30, 1894	$2,214,208.89
Total on present project to June 30, 1894	862,208.89

Money statement.

July 1, 1893, balance unexpended		$138,174.27
June 30, 1894, amount expended during fiscal year		50,383.16
July 1, 1894, balance unexpended		87,791.11
July 1, 1894, outstanding liabilities	$1,101.68	
July 1, 1894, amount covered by uncompleted contracts	30,253.32	
		31,355.00
July 1, 1894, balance available		56,436.11
Amount (estimated) required for completion of existing project		1,475,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for breaking up and removing obstructions from the waterway along the front of League Island, Delaware River, opened March 5, 1894, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Chapman Derrick and Wrecking Company, New York, N. Y	$2,460
2	Townsend & Johnston, Somers Point, N. J	2,308
3	Kelly & Van Sant, Atlantic City, N. J	5,814

All bids rejected, parts of the obstructions having been removed by the owners thereof.

Abstract of proposals for the reconstruction and repair of the dike in Delaware River near Mifflin Bar, between Hog and Maiden islands, opened May 4, 1894, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Approximate quantities.					Amount.
		Yellow pine timber, 6,500 feet, B. M. (per 1000 feet B. M.).	Spikes, 200 pounds, (per pound).	Small stone for filling, leveling up, etc., 7,300 tons, 2,240 pounds (per ton).	Large stone for wall, 11,000 tons, 2,240 pounds (per pound).	Dredging, 46,000 cubic yards (per cubic yard).	
			Cents.			*Cents.*	
1	C. E. Hipple, New York, N. Y	$120.00	20	$1.68	$1.73	19	$40,854.00
2	H. J. Toomey, Guilford, Conn	120.00	20	1.85	1.75	20	42,775.00
3	I. H. Hathaway & Co., Philadelphia, Pa	35.00	3¾	1.45	2.47	10	42,590.00
4	Joseph H. Ward, Ridley Park, Pa.	28.00	1¾	1.19	1.69	10	32,062.50
5	The Brandywine Granite Co., Wilmington, Del	30.00	5	1.00	1.75	10	31,355.00
6	Delaware Construction Co., Wilmington, Del	35.00	4	1.85	1.95	5	37,490.50

Contract (dated May 9, 1894) entered into with The Brandywine Granite Company. In progress.

COMMERCIAL STATISTICS.

The following statements concerning the foreign commerce of the Delaware River for the years ending December 31, 1892 and 1893, are compiled from the reports of the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	Gross tons.	
	1892.	1893.
IMPORTS.		
Asphalt and asphalt blocks	23, 583	20, 093
Burlaps	1, 035	958
Cement	48, 035	54, 811
Chalk	24, 925	38, 475
Clay	9, 269	11, 503
Coal	5, 130	2, 578
Coal tar, and pitch of	2, 384	3, 718
Cork wood	....	1, 092
Cotton and cotton fabrics	668	1, 259
Drugs and chemicals	94, 964	76, 932
Earthenware	....	2, 373
Fertilizers	3, 125	3, 197
Fruits	20, 126	37, 927
Glass and manufactures of	3, 565	1, 175
Glue and glue stock	10, 258	11, 083
Groceries and provisions	1, 926	13, 402
Hair, and manufactures of	4, 600	794
Hemp, jute, flax, and their fabrics	10, 302	15, 788
Hides and skins	....	3, 345
Ice	1, 407	....
Iron, manufactures of	19, 134	15, 047
Iron ore	446, 161	201, 777
Iron, pig	....	7, 491
Iron, scrap	....	1, 372
Leather, and manufactures of	4, 171	184
Live stock and fowls	28	8
Manufactures, other	2, 305	1, 247
Mineral water	896	862
Oil	2, 199	900
Ores, metals, and manufactures of	7, 168	825
Plants and seeds	1, 158	1, 789
Plaster of Paris	18, 033	25, 587
Rags	2, 185	....
Salt	13, 180	11, 267
Silk, and manufactures of	80	93
Stone, and manufactures of	3, 981	3, 375
Sugar, cane and other	392, 433	364, 099
Sugar and molasses	93, 698	89, 714
Sulphur, crude	11, 278	8, 800
Sulphur, ore	46, 932	39, 881
Terra alba	2, 341	2, 334
Tin	42, 462	39, 883
Tobacco	577	647
Wines and liquors	1, 144	1, 087
Wood pulp, paper, and manufactures of	28, 533	12, 555
Wood, and manufactures of	12, 764	14, 600
Wool and wool fabrics	10, 895	7, 045
Miscellaneous	596	1, 842
Total	1, 429, 634	1, 154, 814
EXPORTS.		
Beef, pork, and products	30, 728	28, 080
Cars and locomotives	8, 723	5, 908
Coal	395, 059	322. 654
Corn and cornmeal	487, 216	100, 167
Cotton	4, 184	5, 865
Drugs and chemicals	5, 314	5, 519
Fertilizers	....	9, 930
Flour	164, 511	130, 270
Glucose	10, 676	8, 111
Glue and glue stock	....	4, 135
Groceries and provisions	4, 928	3, 090
Hay	....	1, 618
Hides, leather, and manufactures of	1, 209	610
Iron, and manufactures of	5, 121	3, 546
Live stock	28, 251	5, 304
Manufactures, other	7, 657	1, 195
Metals, other, and manufactures of	401	950
Molasses	10, 754	3, 275
Oats and oatmeal	7, 052	2, 120
Oil cake	23, 111	14, 763
Oils, lubricating	26, 214	29, 020

COMMERCIAL STATISTICS.—Continued.

Articles.	Gross tons.	
	1892.	1893.
EXPORTS—continued.		
Oils, other	6,119	648
Paraffin	8,287	8,316
Petroleum, crude and refined	807,447	918,994
Seeds	461	1,006
Soap, tallow, and grease	6,112	4,124
Tobacco	8,373	7,207
Wheat	267,697	151,538
Wines and liquors	121	44
Wood, and manufactures of	31,063	35,986
Miscellaneous	2,366	2,304
Total	2,359,155	1,816,297

Passengers arriving from and departing for foreign countries.

	1892.	1893.
Arriving	31,427	32,327
Departing	4,903	4,864
Total	36,330	37,191

Comparative statement of gross tons and values of exports, imports, and revenue collected.

Year.	Exports.		Imports.		Revenue.
	Gross tons.	Value.	Gross tons.	Value.	
1888	780,642	$28,012,879	1,016,909	$45,020,132	$20,569,684
1889	851,933	31,403,720	1,108,660	50,996,802	22,612,956
1890	1,502,771	36,462,951	1,424,102	56,057,011	27,572,351
1891	1,540,966	42,845,724	1,381,870	62,438,219	11,121,329
1892	2,359,155	60,274.024	1,429,636	63,277,781	10,886,475
1893	1,816,297	43,416,955	1,154,814	58,870,186	9,899,284

Foreign entrances and clearances.

Class.	Entered from foreign ports.				Cleared for foreign ports.				Total.	
	With cargoes.		In ballast.		With cargoes.		In ballast.			
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
American steam vessels	40	87,721	2	413	36	84,399	4	1,709	82	174,342
American sail vessels	245	123,933	7	7,300	209	126,232	8	3,257	469	260,722
Foreign steam vessels	555	780,374	168	302,659	440	752,852	136	89,840	1,299	1,925,725
Foreign sail vessels	202	151,184	67	88,965	286	265,882	12	5,884	567	511,915
Total	1,042	1,143,212	244	399,337	971	1,229,365	160	100,690	2,417	2,870,704

The following statements concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1892 and 1893, have been compiled from returns made to this office by shippers, consignees, and carriers:

Articles.	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
ARRIVING.				
Brick and terra cotta	23, 644	$236, 570	98, 554	$295, 612
Cement and plaster	10, 439	80, 587	11, 130	92, 276
Chemicals	22, 098	477, 638	31, 608	316, 629
Coal	153, 386	600, 618	559, 181	2, 024, 752
Cotton	6, 894	1, 301, 191	7, 341	1, 151, 115
Fertilizers	31, 719	85, 471	43, 110	620, 912
Grain	144, 804	3, 645, 935	97, 499	1, 975, 031
Hay	6, 486	63, 589	6, 259	37, 081
Ice	607, 294	1, 138, 915	321, 611	615, 747
Iron, manufactured	52, 546	1, 628, 730	28, 921	1, 680, 035
Iron, pig	24, 380	450, 656	73, 342	1, 081, 010
Iron, scrap	6, 150	72, 700	670	16, 650
Lumber	451, 157	4, 075, 142	226, 516	2, 546, 865
Oil	47, 526	738, 522	4, 207	219, 824
Oysters and fish	29, 879	623, 884	15, 073	520, 189
Phosphate rock	59, 414	480, 297	....	....
Produce and fruit	74, 210	2, 886, 023	80, 114	3, 206, 905
Railroad ties	104, 716	628. 296	92, 779	543. 486
Sand	812, 274	420, 804	1, 021, 869	796, 666
Stone, building	103, 575	368, 650	88, 982	660, 230
Stone, paving	60, 010	210, 035	45, 100	291, 400
Sugar	590	34, 176	265	15, 900
Wood, cord	33, 933	107, 790	29, 021	103, 923
Miscellaneous	1, 470, 086	56, 950, 632	1, 168, 860	46, 896, 758
Total	4, 337, 210	77, 306, 851	4, 052, 012	65, 709, 006
DEPARTING.				
Brick	25, 608	106, 624	10, 825	131, 750
Chemicals	19, 713	457, 884	20, 769	343, 326
Coal	4, 306, 023	13, 122, 122	4, 739, 800	16, 407, 117
Cotton	1, 485	288, 134	5, 653	1, 014, 520
Fertilizers	60, 246	1, 019, 606	42, 867	815, 774
Grain	7, 412	188, 384	38, 332	766, 915
Hay	5, 998	62, 910	2, 332	14, 147
Ice	....	....	2, 000	8, 000
Iron, manufactured	75, 272	2, 395, 845	87, 273	4, 363, 650
Iron, pig	57, 605	939, 009	41, 729	541, 007
Lumber	45, 416	406, 785	90, 959	811, 287
Manure	125, 670	139, 185	140, 875	189, 175
Oysters	91, 714	1, 284, 000	....	....
Petroleum and products	52, 366	883, 979	94, 677	1, 471, 602
Produce	14, 987	266, 360	23. 945	960, 700
Sand	49, 582	78, 742	58, 603	82, 360
Sugar	405	48, 600	2, 494	94, 600
Miscellaneous	1, 506, 800	70, 819, 600	900. 227	45, 661. 365
Total	6, 446, 302	92, 507, 779	6, 303, 360	73, 677, 295

Passengers arriving at and departing from Philadelphia.

	1892.	1893.
Arriving	1, 077, 244	1, 371, 143
Departing	1, 095, 498	1. 510, 356
Total	2. 172, 742	2, 881, 499

Domestic and coastwise arrivals and departures in cargo.

Class.	1892.		1893.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	*14, 546	*15, 323	*16, 514	*15, 384
Sailing vessels	7, 220	6, 831	9, 013	6, 887
Canal boats and barges	18, 526	23, 230	†15, 979	‡18, 328
Rafts	322	160	261	188
Total	40, 614	45, 544	41, 767	40, 787

* Excluding tugboats and ferryboats.
† Including 4,870 railroad lighters between Philadelphia and Camden.
‡ Including 4,758 railroad lighters between Philadelphia and Camden.

SUMMARY.

Freight movement.

	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
Foreign:				
Arriving	1, 429, 636	$63, 277, 781	1, 154, 814	$58, 870. 186
Departing	2, 359, 145	60, 274, 024	1, 816, 297	43, 416, 955
Domestic:				
Arriving	4, 337, 210	77, 306, 851	4, 052, 012	65, 709, 009
Departing	6, 440, 302	92, 507, 779	6, 303, 361	73, 477, 295
Total	14, 572, 293	293, 366, 435	13, 326, 484	241, 473, 445

Vessel movement.

	1892.	1893.
Steam vessels, foreign trade, arriving	993	765
Sailing vessels, foreign trade, arriving	625	521
Steam vessels, foreign trade, departing	867	616
Sailing vessels, foreign trade, departing	563	515
Steam vessels, domestic trade, arriving	14, 546	16, 514
Sailing vessels, domestic trade, arriving	7, 220	9, 013
Canal boats and barges, domestic trade, arriving	18, 526	15, 979
Rafts, domestic trade, arriving	322	261
Steam vessels, domestic trade, departing	15, 323	15, 384
Sailing vessels, domestic trade, departing	6, 831	6, 887
Canal boats and barges, domestic trade, departing	23, 230	18, 328
Rafts, domestic trade, departing	160	188
Total	89, 206	84, 971

G 2.

IMPROVEMENT OF HARBOR BETWEEN PHILADELPHIA, PENNSYLVANIA, AND CAMDEN, NEW JERSEY.

The original project for this improvement is contained in the report of a board of engineers dated March 30, 1888, and published in the Annual Report of the Chief of Engineers for 1888. It provides for the removal of Windmill and Smith islands and the adjacent shoals so as to form a 26-foot channel about 1,000 feet wide or wider, if found practicable during the progress of the work, along the front of the revised Philadelphia wharf line from Kaighn Point to the foot of Petty Island. It is further proposed to widen the Pennsylvania channel at

Petty Island so as to give it a width of about 2,000 feet and a depth of 26 feet over a width of about 1,000 feet, more or less, the channel sloping to a depth of 12 feet in the remaining width, and a resulting cross section at half tide of about 55,000 square feet. The quantity of material to be removed was about 18,000,000 cubic yards, place measurement. The cost of the dredging required to carry out this project was estimated at $3,500,000.

This project further provides for the simultaneous regulation of the port wardens' lines of both shores of the river so as to maintain the assigned section of the new channel and the establishment of these lines by actual constructions during the progress of the work. The reconstruction of the water fronts to conform to the new lines will be executed at the expense of the cities of Philadelphia and Camden or the riparian owners. The cost of this reconstruction for a portion of the Philadelphia front from opposite Kaighn Point to opposite the lower end of Petty Island, exclusive of the cost of property for widening Delaware avenue, has been estimated at about $8,000,000.

The original project was modified by Congress by a provision in the sundry civil act, approved March 3, 1891, directing that all dredged material should be deposited and spread on League Island (the cost of which was not included in the original estimates), and by increasing the amount of excavation along the northern shore of Petty Island, provided that the title for the necessary lands should be vested in the United States without charge to the latter.

Under the provisions of this act the line limiting the excavation on Petty Island, staked out in March, 1891, by authority of the Secretary of War, dated March 7, 1891, was definitely established, title to the additional lands acquired for the purpose having been vested in the United States without charge to the latter.

By a provision in the river and harbor act approved July 13, 1892, the project was further modified so as to allow the material removed to be deposited in any place or places approved by the engineer officer in charge of the work, with the proviso that the full amount of material to be deposited and spread on League Island under the existing contract shall be so deposited and spread before the completion of work covered by the contract. Under the modified project the quantity to be removed is about 21,500,000 cubic yards, as measured in scows, and the cost of dredging is estimated at $3,053,000.

The amount expended upon this project to June 30, 1893, was $160,534.52, of which $107,962.56 was expended upon the harbor improvement and $52,571.96 upon filling at League Island.

The total amount of work accomplished to that date was as follows:

Material removed by dredging, scow measurement	cubic yards..	918,537
Piling and revetment removed	linear feet..	7,825
Material deposited on League Island, scow measurement	cubic yards..	614,964

During the past fiscal year work was in progress under a contract with the American Dredging Company, dated June 1, 1893. This contract provides for the complete execution of the work, to be paid for as appropriations may be made from time to time by law; for the commencement of the work on or before July 1, 1893, and by June 30, 1894, for the excavation of at least 3,000,000 cubic yards of material, at least 700,000 cubic yards of which are to be deposited and spread on League Island, and the removal of not less than 14,500 linear feet of pile or timber wharfing or revetment, and for continuance of the work as rapidly as may be required, to the extent of dredging 400,000 cubic yards in any one calendar month, provided funds are available therefor.

Under this contract and during the past fiscal year 14,839 linear feet of timber and piling revetment from Smith and Petty islands and the shores and interior basin of Windmill Island had been removed; 4,924,390 cubic yards of material, as measured in scows, had been excavated from Windmill, Smith, and Petty islands and adjacent shoals by dredging, and 1,021,123 cubic yards as measured in scows, were deposited on League Island.

Smith and Windmill islands were entirely removed to a level of not less than 12 feet below mean low water, and the northern side of Petty Island was dredged back so as to give a minimum width of about 1,400 feet to the Pennsylvania channel at that locality.

The total amount of work accomplished to June 30, 1894, is as follows:

Material removed by dredging, scow measurement	cubic yards..	5,842,927
Piling and revetment removed	linear feet..	22,664
Dredged material deposited and spread on League Island, scow measurement	cubic yards..	1,636,087

During the fiscal year ending June 30, 1895, it is expected that all remaining revetment will be removed; that at least 2,700,000 cubic yards, as measured in scows, will be excavated and deposited and that at least 700,000 cubic yards, place measurement, will be deposited and spread on League Island.

The pile and stone revetment on the north side of the cross channel formerly above Smith Island has been temporarily left in position to support the cables of the telegraph and telephone companies. These cables will be placed in their permanent locations in July, 1894, and the revetment will then be removed.

Under date of January 5, 1894, the Secretary of War approved a revision and extension of the bulkhead and pierhead lines established January 20, 1891. By this action the lines were extended to Harrison street on the Philadelphia side and to Fishers Point on the Camden side.

Under date of January 23, 1894, the Secretary of War authorized the construction and extension of piers, on and after May 1, 1894, between the bulkhead and pierhead lines along the Philadelphia water front between Moore street and Otis street (Susquehanna avenue), subject to the regulations recommended in my letter to the Department, dated January 15, 1894, a copy of which is appended hereto.

During the past fiscal year permission has been given by the port wardens for the extension of one pier along the Philadelphia water front, and along the Camden front 500 feet of bulkhead and one pier 100 feet wide were constructed. Arrangements are in progress for the reconstruction of the piers belonging to the city of Philadelphia, and other riparian owners are considering projects for pier extensions. Detailed information with reference to this subject is given in a letter, dated July 2, 1894, from Mr. W. R. Tucker, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

The commercial statistics pertaining to this work are included in the statistics accompanying the report for improvement of Delaware River.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1893, revenue to the amount of $9,899,284.58.

The nearest fort and light-houses are, respectively, Fort Mifflin and Schuylkill River range lights.

APPROPRIATIONS.

Act of—	
August 11, 1888	$500,000.00
September 19, 1890	200,000.00
March 3, 1891	300,000.00
August 5, 1892	41,000.00
March 3, 1893	500,000.00
Total	1,541,000.00
Total appropriations under present project to June 30, 1894	1,341,000.00

EXPENDITURES.

Total to June 30, 1894		$1,211,327.36
Under present project for dredging and removal of pile and timber revetment	$763,069.82	
For depositing and spreading dredged material on League Island	148,257.54	
		911,327.36

Money statement.

July 1, 1893, balance unexpended		$1,080,465.48
June 30, 1894, amount expended during fiscal year		750,792.84
July 1, 1894, balance unexpended		329,672.64
July 1, 1894, outstanding liabilities	$156,093.38	
July 1, 1894, amount covered by uncompleted contracts	173,579.26	
		329,672.64
Amount (estimated) required for completion of existing project		2,259,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1896		1,000,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

LETTER OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS, RECOMMENDING THAT THE CONSTRUCTION AND EXTENSION OF PIERS BETWEEN THE BULKHEAD AND PIER HEAD LINES ALONG THE PHILADELPHIA WATER FRONT BETWEEN MOORE STREET AND OTIS STREET BE AUTHORIZED, AND SUBMITTING REGULATIONS TO GOVERN THE SAME.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., January 15, 1894.

GENERAL: The work of excavation in the harbor of Philadelphia is now so far advanced that it is desirable to extend as many piers as possible to the new pier-head line between Moore street and Otis street, as soon as the cross dikes in the harbor are removed. These dikes will be removed on or before May 1, 1894.

On December 12, 1892, the advance of piers between Moore and Queen streets was authorized by the Secretary of War, subject to the following regulations:

1. All piers hereafter constructed or extended must extend to the pier-head line.
2. No cribs or other structures shall be hereafter constructed between the bulkhead and pier-head lines below a level 2 feet above mean high water.
3. In the construction of new piers or the extension of old ones, the pile groups supporting the superstructure shall be at least 10 feet apart.

I have the honor to recommend that the construction and extension of piers, on or after May 1, 1894, between the bulkhead and pier-head lines along the Philadelphia water front between Moore street and Otis street (Susquehanna avenue), be now authorized, subject to the above regulations, and that all structures hereafter erected within those limits which are not in accordance with said regulations be considered in violation of section 12 of the act of September 19, 1890.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER FROM MR. W. R. TUCKER, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO WHAT HAS BEEN ACCOMPLISHED IN THE WAY OF THE RECONSTRUCTION OF THE DELAWARE RIVER WATER FRONT OR THE PREPARATION THEREFOR, DURING THE FISCAL YEAR ENDING JUNE 30, 1894, WITH FOUR INCLOSURES.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., July 2, 1894.

SIR: I beg to acknowledge the receipt of your communication, under date of April 7, in which you ask to be furnished with a concise statement of what has been accomplished since June 30, 1893, in regard to the reconstruction of the Delaware River water front or in preparation therefor.

I have delayed my reply to your inquiry in order that I might be able to report the progress of the work to the end of the Government year, June 30.

Under date of December 2, 1893, the board of harbor commissioners transmitted to city councils a lengthy report, giving a detailed account of the progress made up to that time on the work of the improvement of the harbor, and urging upon its attention the necessity of at once taking steps for the widening of Delaware avenue, the commencement of bulkhead construction, and the extension of certain piers owned by the city. Copy of the report is transmitted herewith, and marked A.

On January 4, 1894, there was presented to city councils a preamble and resolution adopted by the joint committee on the improvement of the harbor, representing the trade, commercial, and maritime associations of Philadelphia, petitioning for "such action as will provide for the physical widening of Delaware avenue, the construction of a bulkhead on the Delaware River along the new bulkhead line, and the extension of such piers belonging to the city as may be agreed upon on consultation between Maj. C. W. Raymond and the department of public works, bureau of surveys." Copy of the preamble and resolution inclosed herewith, and marked B.

The report of the harbor commissioners and preamble and resolution of the joint committee were, by vote of councils, referred to the committee on surveys, which in turn referred same to the department of public works, bureau of surveys.

The chief engineer of the city has now in course of preparation a plan for the extension of certain piers owned by the city and the construction of a new bulkhead along the river front, and I would respectfully refer you to a copy of his letter (inclosed, and marked C), addressed to me under date of June 28, as to the progress that is being made upon the said plans.

The board of harbor commissioners has had several conferences with the trustees under the will of Stephen Girard, who have expressed a willingness to appropriate a portion of the funds held by them "for the construction of stone bulkheads and for other similar purposes" along the Delaware River between Vine and South streets, the limits of the old city. The trustees have also stated in a communication that "the Girard estate is ready, as soon as the condition of collateral improvements makes it wise to do so, to take into consideration the extension" of piers Nos. 1 and 2, north wharves, which are owned by the estate. The trustees have referred the subject to a committee, consisting of Messrs. Jos. L. Caven, esq., Louis Wagner, esq., and B. B. Comegys, esq., which will cooperate with the harbor commissioners when the city councils receive the report of the chief engineer.

On February 2, 1894, the board of harbor commissioners transmitted to James H. Windrim, esq., director of public works, a communication announcing, under your authority, the opening of the city front for the extension of wharves between Moore street and Otis street (Susquehanna avenue). Copy of the communication inclosed and marked D.

I am pleased to announce that the William Cramp & Sons Ship and Engine Building Company were the first riparian owners to avail themselves of the privilege of extension to the new pier-head line, and, on the 25th of June, the board of port wardens granted the company a license to extend their pier just above Palmer street, under the restrictions as to character of construction authorized by the Secretary of War. Work will begin at once upon this pier.

I am further pleased to inform you that the same company has filed application with the port wardens for the extension of three large piers south of Cumberland street to the new pierhead line, covering about 1,000 feet of river front.

The Philadelphia and Reading Railroad Company has also presented a like application for the construction of a pier just north of Cumberland street. None of these applications can be acted upon until the Secretary of War shall allow the extension of wharf structures to the new pierhead line north of Otis street (Susquehanna avenue).

I learn that the board of port wardens is advised that a number of other riparian owners are considering projects for pier extensions at different parts of the river front, thus indicating that the facilities for improvement given by the Government work are being appreciated.

On the Camden side of the harbor the Pennsylvania Railroad Company has constructed 500 feet of bulkhead along the new bulkhead line on the property of the Camden and Philadelphia Ferry Company north of the ferry landing, while just south of the ferry the same company has extended a pier 100 feet wide out to the new pier-head line.

I am, sir, your obedient servant,

W. R. TUCKER,
Secretary.

Maj. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, December 2, 1893.

GENTLEMEN: The accompanying copy of a letter of Maj. C. W. Raymond, consulting engineer to the board of harbor commissioners for the city of Philadelphia, is respectfully transmitted to your honorable bodies with the following statement explanatory of the situation of the harbor improvement at this date:

The work projected, and now in progress, by the U. S. Government, was only undertaken as initiative to the development of the wharves and docks along the city water front, since without the former the latter would be impossible, and without the latter the former is more than useless. From the very inception of the great improvement, the reorganization and development of the docks, wharves, and water front of the city have always been considered as a sequel to the removal of the islands and shoals by the Government, and without this assurance the work on the part of the United States would never have been projected and provision by law made for its continuance and ultimate completion. This correlation between the work to be done by the Government and that to be accomplished by the city and its private and corporate interests, was most fully indorsed by petitions of city councils for the inauguration of the work by the United States, with the understanding that the city and its allied interests might be relied upon for the reconstruction of the Philadelphia water front.

In this connection a résumé of actions and operations relating to this improvement may be of value in clearly presenting the subject to your attention.

Under the date of January 4, 1888, the board of harbor commissioners had the honor of transmitting to your honorable bodies a report of its U. S. advisory commission "concerning the physical relations of Smiths and Windmill islands, and shoals adjacent thereto, to the improvement of the harbor," in which it recommended the improvement of the harbor by the removal of the islands and shoals obstructing the same, and presented a general plan for the work.

On March 30, 1888, a board of engineers, appointed under a joint resolution of the Senate and House of Representatives, submitted, with favorable recommendations, a project for the removal, by the Government, of certain islands and shoals in the port of Philadelphia, so as to permit the widening of a part of Delaware avenue and the extension of the wharves along the city water front.

On August 11, 1888, Congress appropriated $500,000 for the commencement of the work, with the proviso that $300,000 of said appropriation could be used in acquiring title to the islands to be removed; the balance required for their purchase was furnished by the State of Pennsylvania by act of assembly passed in 1889, and the city of Philadelphia by ordinance enacted in 1890. Windmill, Smiths, and the required part of Petty Island were secured and the title thereto vested in the United States May 29, 1890.

On April 23, 1891, a contract was entered into with Messrs. James A. Mundy & Co., for the work to be done by the United States under the project of the Board of U. S. Engineers of 1888. After two seasons of unsuccessful work by the contractors, the contract was annulled by the Government in December 1892, and on June 1, 1893, a new contract was entered into for the work with the American Dredging Company. Under this contract work has been in progress since July 1. There has now been removed, altogether, more that 2,000,000 cubic yards of material. This work has secured the removal of Windmill Island and adjacent shoal to a depth of 12 feet at mean low water, the removal of the major part of Smiths Island and Smiths Island Bar, and the material widening of the Pennsylvania channel along the front of Petty Island.

The energy with which the contract has been prosecuted by the present contractors has caused the work to advance beyond the requirements of the contract, and in a corresponding ratio it will probably continue to do so in the future.

This rapid prosecution of the work will bring the improvement, at a somewhat earlier date than anticipated, to that stage when it becomes imperatively necessary that the city should actively undertake its part of the scheme, or else the Government work in progress may be brought to a standstill. The result of such a contingency would be most deplorable, since it would not only vitiate much of the work done by the United States, but also the city and its commercial interests would fail to perform their part in the mutual obligation with Government.

In anticipation of active operations on the part of the city of Philadelphia and allied interests, the U. S. Government has fixed the harbor lines along that part of the city water front lying between Moore and Otis streets, and has under consideration for early recommendation the establishment of similar lines from Otis street to a point about 3½ miles above Otis street. Regulations governing the extension and construction of wharves along the city water front have also been accepted and promulgated by the United States.

To meet the exigencies and requirements of the situation, the following action has been taken by your honorable bodies and the State legislature in conformity with the recommendations of this board:

(*a*) The State legislature, in response to a resolution of select and common councils, passed "A supplement to 'An act empowering councils in cities of the first class to revise and establish the line for wharves and piers and low-water mark or bulkhead lines on the Delaware river in front of cities of the first class,' approved June 8, 1891, and to further authorize the acquisition by said cities of wharves, piers, bulkheads, and riparian rights, and to prescribe and carry out the plans for the construction of said wharves, piers, and bulkheads." (P. L., 281, 1893.)

(*b*) The form of ordinance as submitted in the last report of the harbor commissioners, regulating wharf construction along the river front between Moore street and Queen street, conforming to the regulations prescribed by the Secretary of War under provisions of section 12 of the act of Congress of September 19, 1891, was passed by your honorable bodies and approved by the mayor March 22, 1893.

(*c*) In following out the recommendations of this board as to widening Delaware avenue, an ordinance was passed entitled "An ordinance to authorize the revision of lines and grades of Delaware avenue from Christian street to the angle in said Delaware avenue, northeast of Laurel street, and to make the width thereof not less than 150 feet."

From the foregoing it will be seen that, up to the present time, projects, plans, legislation, and other actions on the part of the Government, State, and city and its allied interests, have all been directed toward a common end, viz, the development of the commercial interests of the port of Philadelphia through the widening of Delaware avenue and the extension of the wharves so as to meet the requirements of modern commerce.

The time is at hand when it has become necessary that action should be taken on the part of the city of Philadelphia to supplement the work undertaken by the Government, and attention is respectfully directed to the inclosed communication of Maj. C. W. Raymond bearing upon this subject, in which it is recommended that action be at once taken toward the commencement of bulkhead construction and the extension of certain piers owned by the city.

In view of all these facts, the board of harbor commissioners for the city of Philadelphia most respectfully urges upon the consideration of your honorable bodies the necessity *at this time* of taking the necessary steps to inaugurate the work which Maj. Raymond now recommends; thereby establishing and maintaining the proper harmony between the two parts of the work of improvement, and preventing the possibility of the Government being obliged to suspend operations in the near future until reasonable progress in the re-construction of the water front is assured by the city of Philadelphia.

Truly appreciating the work of organization and preparation which will be required before active operations can be commenced upon the work therein recommended, the board of harbor commissioners feels justified in emphasizing the need for early consideration of these recommendations, and such action on the part of city councils as will insure the prompt commencement of the work.

The board of harbor commissioners would respectfully suggest that the subject of the extension of piers belonging to the city be referred to the department of public works, bureau of surveys, in consultation with Maj. C. W. Raymond, U. S. Army, Corps of Engineers, in charge of the Government work, to consider what city piers should be advanced, and how and when the work ought to be done for the best interests of the city and the permanent improvement of the harbor.

Respectfully, yours,

CHARLES PLATT,
EDWIN A. GASKILL,
W. R. TUCKER,
JOEL COOK,
WM. D. WINSOR,
GEO. S. WEBSTER,
EDWIN S. CRAMP.

THE SELECT AND COMMON COUNCILS OF THE CITY OF PHILADELPHIA.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., November 13, 1893.

DEAR SIR: I have the honor to acknowledge the receipt of a copy of the resolution adopted by the board of harbor commissioners on the 9th instant, requesting me to report to the board "what action is now necessary and desirable on the part of the city of Philadelphia to supplement at this time the work of the Government for the improvement of the harbor." I reply, I beg leave to submit the following remarks:

The work now in rapid progress under the General Government consists in the removal of islands and shoals to permit the widening of Delaware avenue and the extension of the piers along the water front of the city. The plan adopted by Congress requires the extension of the solid filling and piers during the progress of the work as a necessary part of the improvement. The work was undertaken by Congress upon the petition of the city councils and the leading commercial bodies, and with the distinct understanding that the city and the riparian owners might be relied upon for the reconstruction of the water front.

The new harbor lines have been established from Moore street to Otis street, and they will doubtless be soon extended about 3 miles further up the river. These lines are established subject to the condition that wharves shall only be extended to them at such times and places as may be approved by the Secretary of War.

As regards possible constructions along the Philadelphia water front, the present situation is as follows:

1. The construction of bulkheads along the new line from Moore street to Otis street has been authorized by the War Department since January 2, 1891.
2. The construction and extension of piers to the new line from Moore street to Queen street have been authorized by the War Department since December 12, 1892.
3. Before the end of next month the islands will have been entirely removed to a minimum depth of 18 feet below mean high water, and the advance of piers as far north as Walnut street will doubtless then be authorized.
4. The wooden dikes north of Smiths Island can not now be removed, as one of them is temporarily occupied by electric cables employed for the telegraph and telephone service of the city. The dikes will be removed next spring, and pier construction will doubtless then be authorized as far north as Otis street.

As shown by this statement, more or less work of construction on the water front has been authorized by the War Department for a period of nearly three years, yet absolutely nothing has been accomplished on the Philadelphia side of the harbor. On the Camden side about 650 feet of bulkhead have been constructed and one wharf has been extended to the new line.

Up to the present time the advance of piers and bulkheads along the Philadelphia front, although desirable, has not been considered immediately necessary, the channel volume not having been unduly increased by the work of excavation. I consider it now desirable and necessary to commence the work of bulkhead construction without delay, and, if possible, advance some of the piers. If the piers owned by the city at the foot of Dock and Chestnut streets could be extended to the new line (the first immediately and the second next spring) it would be of very great assistance in the improvement of the harbor.

I will not attempt to explain in detail the reasons upon which these recommendations are based, my views having been frequently submitted to the board in verbal statements and written reports. I will only say that the work of excavation must and will advance rapidly, and unless the construction of piers and bulkheads makes corresponding progress a serious increase of the rate of shoaling in the docks must be anticipated. Attention is invited to section 5 of the act of July 13, 1892, which prohibits the expenditure of money for dredging inside of harbor lines duly established. From this it will be seen that no deposit along the water front can be removed by the General Government, and the importance of advancing the piers to prevent such deposits is evident.

It is not my desire to find fault with the city or the riparian owners for having postponed action in this matter, for I am aware of the practical difficulties which have been encountered, and also of the serious financial depression during the past season.

Further delay, however, would in my opinion be very unfortunate. Congress has already appropriated $1,541,000 for this improvement, and the work is progressing in the most rapid and satisfactory manner. Further appropriations will soon be necessary if the work is to go on; but unless immediate action is taken by the city, it may be considered best for the Government to suspend operations until reasonable progress in the reconstruction of the water front is assured.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers, Consulting Engineer.

Mr. CHARLES PLATT,
President Board of Harbor Commissioners for the city of Philadelphia, Pa.

INCLOSURE B.

Whereas Maj. C. W. Raymond, U. S. Army, in charge of the improvement of the Philadelphia harbor, in a communication addressed to the board of harbor commissioners under date of November 13, 1893, says, "I consider it now desirable and necessary to commence the work of bulkhead construction without delay, and, if possible, advance some of the piers," and also that "further delay would, however, in my opinion be very unfortunate. Congress has already appropriated $1,541,000 for this improvement, and the work is progressing in the most rapid and satisfactory manner. Further appropriations will soon be necessary if the work is to go on, but unless immediate action is taken by the city it may be considered best for the Government to suspend operations until reasonable progress in the reconstruction of the water front is assured:" Therefore, be it

Resolved, That the joint executive committee on the improvement of the harbor, representing the Philadelphia Board of Trade, Commercial Exchange of Philadelphia, Philadelphia Maritime Exchange, Philadelphia Drug Exchange, Grocers and Importers' Exchange, Vessel Owners and Captains' Association, Board of Port Wardens and Manufacturers' Club, earnestly petitions the mayor and city councils to take such action as will provide for the physical widening of Delaware avenue, the construction of a bulkhead on the Delaware River along the new bulkhead line, and the extension of such piers belonging to the city as may be agreed upon on consultation between Maj. C. W. Raymond and the department of public works, bureau of surveys.

INCLOSURE C.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, June 28, 1894.

DEAR SIR: In reply to your letter of June 11, 1894, in which you request a statement of the work done in this bureau upon the plans for piers and bulkheads upon the Delaware River front of the city of Philadelphia, I would state that plans showing existing wharf properties, with the names of the owners, have been prepared; also, plans at the present time are being prepared for extending two piers on the river front immediately opposite the former location of Smith and Windmill islands.

Meetings have been held at the office of the director of the department of public works with Maj. Raymond, in charge of the Government work, and also with the board of directors of city trusts in reference to expenditures along the Delaware River front in the city proper from funds available in the Girard estate, and it is hoped by the middle of July that final arrangements may be made to begin the construction of at least two piers.

The district surveyors have been at work for several months upon the plans for widening Delaware avenue preparatory to the construction of the bulkhead. All the work is progressing as rapidly as possible.

Yours, truly,

GEORGE S. WEBSTER,
Chief Engineer.

WILLIAM R. TUCKER, Esq.,
Secretary Board of Harbor Commissioners.

INCLOSURE D.

SIR: I have the honor to inform you that the Secretary of War, under date of January 23, 1894, authorized the construction and extension of piers, on or after May 1, 1894, between the bulkhead and pier-head lines along the Philadelphia water front, between Moore street and Otis street (Susquehanna avenue), as established on January 20, 1891, and January 5, 1894, subject to the following regulations, which are prescribed under the provisions of section 12 of the act of September 19, 1890:

1. All piers hereafter constructed or extended must extend to the pier-head line.
2. No cribs or other solid structures shall be hereafter constructed between the bulkhead and pier-head lines below a level 2 feet above mean high water.
3. In the construction of new piers or the extension of old ones the pile groups supporting the superstructure shall be at least 10 feet apart.

All structures hereafter erected between the bulkhead and pier-head lines, between Moore street and Otis street (Susquehanna avenue), which are not in accordance with these regulations will be considered in violation of section 12 of the act of September 19, 1890.

A plan showing the pier-head and bulkhead lines from Moore street to Otis street (Susquehanna avenue), as established by the Secretary of War, within which constructions were conditionally authorized by the Secretary of War on January 23, 1894, and a written description of the same, are transmitted herewith.

I respectfully recommend that the board of harbor commissioners now officially file this plan, with the accompanying descriptions and conditions, in the bureau of surveys, department of public works, in accordance with the provisions of section 2 of an ordinance of city councils establishing the revised line beyond which no wharf or pier shall extend, and the arbitrary low-water line or bulkhead line on the Delaware River, in front of the city of Philadelphia, approved October 7, 1891.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

DESCRIPTION OF PIERHEAD LINE.

Beginning at a point in the pierhead line, established by the Secretary of War January 20, 1891, 750 feet from the west side of Delaware avenue on the prolongation of the south side of Poplar street, and running thence to a point on the prolongation of the west side of Shackamaxon street, and distant 857 feet from the north side of Delaware avenue; thence to a point on the prolongation of the west side of Palmer street, and distant 777 feet from the north side of Beach street; thence to a point 1,370 feet from and perpendicular to the north side of Bath street at a point 55 feet westerly from the west side of Ann street.

DESCRIPTION OF BULKHEAD LINE.

Beginning at a point on the prolongation of the south side of Vine street, and distant 150.75 feet from the west side of Delaware avenue, and running thence to a point 242 feet from and perpendicular to the west side of Delaware avenue at a point 85 feet southerly from the south side of Fairmount avenue; thence to a point 240 feet from and perpendicular to the north side of Delaware avenue at a point 152 feet westerly from the west side of Shackamaxon street; thence to a point 277 feet from and perpendicular to the north side of Beach street at a point 66 feet westerly from the west side of Palmer street; thence to a point 335 feet from and perpendicular to the west side of Beach street at a point 30 feet southerly from the south side of Plum street.

C. W. RAYMOND,
Major, Corps of Engineers.

MR. PLATT TO DIRECTOR WINDRIM.

DEAR SIR: In compliance with a resolution of the board of harbor commissioners, adopted at a meeting held on the 16th instant, and in accordance with an order of city councils, approved October 7, 1891, under the provisions of an act of assembly of June 8, 1891, I have the honor of transmitting you herewith copy of a communication from Maj. C. W. Raymond, Corps of Engineers, U. S. Army, dated February 2, 1894, which, under the authority of the Secretary of War, authorizes the construction and extension of piers, on and after May 1, 1894, between bulkhead and pierhead lines along the Philadelphia water front, between Moore street and Otis street (Susquehanna avenue), as established January 20, 1891, and January 5, 1894, under certain restrictions as to method and character of construction therein prescribed.

Attention is invited to the changes made in the bulkhead line above Vine street and the pier-head line above Poplar street, which are shown upon a plan accompanying this and recited in an official description by Maj. Raymond, copy of which is also transmitted.

Will you kindly direct the filing of the accompanying plan of said harbor lines and description of same in the bureau of surveys, in accordance with the ordinance referred to above?

I have the honor to be, your obedient servant,

CHAS. PLATT,
President.

G 3.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

This river, between its mouth and Gibson Point, in its unimproved condition, carried a channel over the bar directly at its mouth with a depth of about 10 feet at mean low water, and between the bar and Gibson Point a ruling depth of about 16 feet.

The original project proposed the formation of a channel 400 feet wide and 24 feet deep at mean low water from the mouth of the river to Girard Point, a distance of about 1 mile; from thence to Gibson Point, a farther distance of about 3 miles, a channel 20 feet deep and 250 feet wide, except at the abrupt bend at Yankee Point, where the channel width was to be increased to 300 feet; from thence to Chestnut street bridge, Philadelphia, a distance of about 3 miles, a channel of navigable width and 18 feet deep at mean low water. This latter reach of river has required no other improvement than the removal of about 1,000 cubic yards of rock near Locust and South streets.

This work was to be done entirely by dredging, and its cost was estimated at $485,000. Although the work has been considerably increased by shoaling, it can be completed at a total cost of $485,750.

The results of a large part of the work executed between Girard Point and the mouth having proved to be temporary, the project was modified in 1892 so as to provide for the construction of dikes on the west side of the mouth at an estimated cost of $44,209. The estimated cost of the whole modified project is $529,959.

The improvement of the channel of the Schuylkill River by dredging was commenced in 1870, and up to the close of the fiscal year ending June 30, 1892, about 1,416,000 cubic yards of material had been removed, of which about 550,000 cubic yards were dredged in deepening the channel near the mouth between the Delaware River and Girard Point, a distance of about 1 mile. The remaining 866,000 cubic yards were removed from between Girard Point and Gibson Point, a distance of about 3 miles. A dangerous obstruction to navigation, consisting of about 400 cubic yards of material, was also removed from the channel above Penrose Ferry bridge.

During the fiscal year ending June 30, 1893, two earthen dikes, having an aggregate length of 2,797 feet, and a pile dike 800 feet in length were constructed for the improvement of the channel at the mouth.

Under date of November 17, 1892, a contract was entered into with the American Dredging Company, of Philadelphia, Pa., for the removal by dredging of about 170,000 cubic yards of material, scow measurement. Work under this contract was completed January 15, 1894, by the aggregate removal of 181,081 cubic yards of material, of which 18,491 cubic yards were compact gravel, clay, and bowlders. During the operations of dredging in the vicinity of Gibson Point, rock was developed in the middle of the cut, about 100 feet within the limits of the project, with 18 feet of water over it. This has been buoyed by the U. S. Light-House Establishment.

Under an open market agreement, dated March 29, 1894, with Frank C. Somers, of Camden, N. J., 7,285 cubic yards of material, at 10½ cents per cubic yard, were dredged and cast up to repair the injuries done to the dikes by the storms and high water during the fall and winter of 1893, at a total cost of $845.42.

Under an open market purchase from T. W. Perkins, 300 willows, at 8 cents each, were planted along the length of the earthen dike for its protection and preservation at a total cost of $24.

This work has resulted in the formation of a channel about 150 feet wide and from 18 to 21.4 feet deep at mean low water across the bar at the river's mouth; a channel about 250 feet wide and from 20 to 24 feet deep from inside the bar to Gibson Point, except at Yankee Point, where the width is 300 feet. Between Gibson Point and deep water inside the bar at the mouth the improved channel has maintained the depth to which it was dredged. An examination made at the close of the past fiscal year shows that the channel at the mouth has deepened 2 feet, the minimum depth being 21.4 feet at mean low water. The distance across the bar is lessened 270 feet, the 24-foot curves on either side having approached each other.

The present demands of commerce limit the requirement of an improved channel to that part of the river lying between the mouth and Gibson Point, or the lower 4 miles of the river. At Girard Point are located large grain elevators and wharves. At Gibson Point and Point Breeze, which are near each other and closely related as to commercial requirements, are the large storage tanks and wharves of the petroleum oil refineries. The interests assembled at these three points cover mainly the commerce of the Schuylkill River, and both the grain and oil trade require deep-draft vessels for the proper and economical transaction of their business. Channel depths should exist which will permit the passage of vessels drawing 24 feet of water at all stages of the tide between the mouth of the river and Gibson Point.

The dredged channels which have been formed elsewhere than at the mouth have been permanent, and if by regulating works at the mouth a 24-foot channel can be maintained, it is believed that a permanent channel of equal depth can be formed by dredging in the reach of river between the mouth and Gibson Point. Until such a channel is formed deep draft vessels can only be moved at high water, unless they lighter a part of their cargoes over the outer bar.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1893, revenue to the amount of $9,899,284.58. The nearest fort and light-houses are, respectively, Fort Mifflin and Schuylkill River range lights.

APPROPRIATIONS.

Act of—		Act of—	
June 11, 1870	$15,000	March 3, 1881	$40,000
March 3, 1871	10,000	August 2, 1882	25,000
June 10, 1872	40,000	July 5, 1884	25,000
March 3, 1873	40,000	August 5, 1886	18,750
June 23, 1874	20,000	August 11, 1888	25,000
March 3, 1875	20,000	September 19, 1890	45,000
August 14, 1876	20,000	July 13, 1892	46,250
June 18, 1878	30,000		
March 3, 1879	25,000	Total	485,000
June 14, 1880	40,000		

EXPENDITURES.

Total to June 30, 1894	$477,884.78

Money statement.

July 1, 1893, balance unexpended	$31,215.41
June 30, 1894, amount expended during fiscal year	24,100.19
July 1, 1894, balance unexpended	7,115.22

Amount (estimated) required for completion of existing project	$44,959.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	44,959.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The following statements of the foreign and domestic commerce of the Schuylkill River for the years ending December 31, 1892 and 1893, have been compiled from the returns made to this office by shippers, consignees, and carriers:

Freight movement.

Articles.	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
ARRIVING.				
Asphalt	17,600	$263,600	18,925	$216,211
Chemicals	3,280	80,916	16,614	76,778
Clay	6,618	19,864	7.016	13,642
Coal	213,164	738,876	301,672	1,135,052
Hay	1,422	11,220	162	1,854
Ice	179,527	329,626	90,040	160,905
Iron ore	56,191	147,129	46,906	98,593
Lumber	27,891	249,386	8,314	102,130
Marble	5,579	161,562	....	....
Stone, building	42,420	261,882	71,579	527,820
Stone, paving	13,350	44,875	14,000	70,000
Sand	242.840	150,973	357,377	278.532
Wood	30,828	159,895	1,858	5,677
Miscellaneous	13,878	287,633	42,439	1,252,530
Total	854,588	2,898,457	976,902	3,039,724
DEPARTING.				
Asphalt	2,478	74,340	2,205	80,325
Chemicals	....	....	2,345	22,726
Coal	5,093	14,279	15,555	62,220
Grain	392,001	9,622,983	146,000	2,900,000
Manure	28,327	32,615	38,425	51,200
Petroleum oil and products	811,536	13,597,166	1,059,590	13,032,949
Miscellaneous	40,520	479,626	24,202	1,649,304
Total	1,309,955	23,821,009	1,288,412	17,798,724

Vessel movement.

Class.	1892.		1893.	
	Number arriving loaded.	Number departing loaded.	Number arriving loaded.	Number departing loaded.
Steamers	610	1,076	782	930
Sailing vessels	665	272	500	231
Barges and canal boats	2,870	1,108	3,763	1,191
Total	4,145	2,456	5,045	2,352

G 4.

IMPROVEMENT OF ICE HARBOR AT MARCUS HOOK, PENNSYLVANIA.

The harbor of Marcus Hook is situated on the right bank of the Delaware River, about 20 miles below Philadelphia. Its construction and maintenance as an ice harbor was undertaken by the General Government in 1866.

The work accomplished in 1889 practically carried the project for the improvement of this harbor to completion. The harbor in its present condition consists of an area of 10 acres, with a depth of from 18 to 25 feet at mean low water over about 7½ acres, and from 18 to 12 feet over the remaining 2½ acres. Within this area are seven detached ice piers, consisting of stone superstructures upon timber-crib substructures, two landing or shore piers of timber with crib substructures upon pile foundations, and three groups of mooring piles placed between the detached ice piers.

The four upper ice piers were completed in 1871, and during the twenty-three years which have elapsed the wear of the ice upon the upper surfaces of the timber substructure, which is but slightly below the plane of mean low water, will necessitate, in the near future, repairs to this worn part of the substructure.

It is also probable that dredging will have to be resorted to at intervals to maintain the requisite depth of the water in the harbor.

During the fiscal year ending June 30, 1893, two landing piers were repaired, seven groups of mooring piles were established to replace those which had decayed, and one group was repaired.

Under an open market agreement, dated December 21, 1893, with I. H. Hathaway & Co., the two landing piers were repaired and one group of mooring piles was placed in the harbor, at a total cost of $416.99.

The funds now available are considered sufficient for all probable necessities.

This work is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1893, amounting to $9,899,284.58. The nearest fort and light-house are, respectively, Fort Mifflin and Christiana Light.

APPROPRIATIONS.

Act of—		Act of—	
June 23, 1866	$5,000	August 5, 1886	$15,000
March 2, 1867	94,000	August 11, 1888	15,000
January 14, 1880	35,000	September 19, 1890	5,000
March 3, 1881	30,000		
August 2, 1882	15,000	Total	214,000

EXPENDITURES.

Total to June 30, 1894	$211,052.61

Money statement.

July 1, 1893, balance unexpended	$3,364.38
June 30, 1894, amount expended during fiscal year	416.99
July 1, 1894, balance unexpended	2,947.39

G 5.

ICE HARBOR AT HEAD OF DELAWARE BAY, DELAWARE.

The act of August 2, 1882, contained an appropriation of $25,000 for "ice harbor at head of Delaware Bay, and for removal of sunken piers in channel back of Reedy Island, Delaware." The sum of $3,700 was expended in 1883 in removing the sunken piers at Reedy Island, and $5,063.07 has since been expended in surveys, examinations, and office expenses.

Several plans for the formation of an ice harbor in the vicinity of Liston Point have been proposed, but the difficulties connected with the problem have been such that a satisfactory solution has not yet been reached. Those who have studied the question are unanimous in the opinion that if such an ice harbor is built it should be located in the reach of river between Reedy Island and Bombay Hook Point. This part of the river contains two localities, viz, Baker Shoal and Duck Creek Flats, the improvement of which is provided for in the project for the permanent improvement of the Delaware River between Philadelphia and the sea, by the construction of over 11 miles of dikes. The changes which would be induced in the regimen of this part of the river by such extensive constructions would render the prior location of an ice harbor very hazardous.

The greatest need of commerce on the Delaware River is an improved ship channel between the port of Philadelphia and the sea, and until this shall have been carried further toward accomplishment, expenditures can be applied with more advantage to channel improvements than to ice-harbor construction.

The cost of an adequate ice harbor in the vicinity of Liston Point would probably be from $400,000 to $600,000, and after other requirements of commerce have been met such an ice harbor would be a desirable adjunct.

APPROPRIATIONS.

Act of August 2, 1882	$25,000

EXPENDITURES.

Total to June 30, 1894	$8,763.07

Money statement.

July 1, 1893, balance unexpended	$16,236.93
July 1, 1894, balance unexpended	16,236.93

G 6.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

The construction of this pier was commenced in 1871 under an appropriation of $225,000 made in the river and harbor act of July 15, 1870. By the conditions of this act the Junction and Breakwater Railroad Company, having the terminus of its line in the vicinity of the pier, was permitted "to extend their railroad upon and over said pier, and to freely use said pier in connection with their said road, subject to such regulations and charges for maintenance and repairs as the Secretary of War may adopt." The pier was completed in 1880, and expenditures since that date have been applied to the repair and maintenance of the structure. The railroad company has not yet exercised its privilege of occupying the pier.

In 1888 and 1889 the pier was injured by the collision of vessels which had been driven from their moorings behind the adjacent breakwater by severe storms. About 120 linear feet of the pier was wrecked by these collisions, involving the destruction of 17 of the wrought-iron screw piles and their attachments.

The pier was thoroughly repaired in 1891 at a cost of $7,033. These repairs are described in detail in the Annual Report of the Chief of Engineers for 1891, p. 1074. There were no operations during the past fiscal year.

The right to use this pier for railway purposes, granted in the act of July 15, 1870, has never been exercised, and doubtless never will be, as the pier has not sufficient strength to safely support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure. It is suggested that this right, having been waived for a period of thirteen years, be now revoked by Congress.

A large part of the timber superstructure is now greatly impaired by natural decay. The covering and some of the timbers are in a dangerous condition, and if the pier is to be maintained by the United States and used, as heretofore, for the general benefit of commerce, it should be thoroughly repaired as a matter of public safety. The cost of such repairs will not exceed $6,300.

The pier is of great use for the purposes of the engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor, especially in exceptional seasons like the winter of 1892–'93, when the harbor was packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek the shelter and protection of the pier.

During the ice period of the winter of 1892–'93 the pier suffered some injuries from ice or vessels. The cluster piles at the pier head were broken and five fender piles were torn out. The repair of these injuries is estimated to cost about $650.

The need of clear regulations governing the use of this pier and the neighboring anchorage, under the shelter of the Delaware Breakwater, became very apparent in the winter of 1892–'93 during the season of ice and storms, when the harbor was crowded with shipping. Such regulations would be useless unless some representative of the Government is present with authority to enforce them. Legislation providing for the establishment of such regulations, with penalties for their enforcement, and the appointment of a harbor master, is respectfully recommended. By the appointment of one of the agents of the maritime exchange living on the breakwater a suitable person to fill this position can be obtained at very moderate cost. Since his services will only be occasionally required, a compensation not to exceed $20 per month is considered sufficient. A watchman at the pier to protect the Government property is necessary, and has heretofore been maintained at a cost of $10 per month. A small sum should also be kept on hand for urgent repairs of unexpected injuries. For this purpose $500 per year is considered sufficient.

In accordance with above recommendations, the following estimate of funds required during the next fiscal year is respectfully submitted:

Repairs of superstructure	$6,300
Repairs of fender piles	650
Urgent repairs of unexpected injuries	500
Pay of harbor master	240
Pay of watchman	120
Total	7,810

This pier is in the collection district of Delaware, the nearest port of entry being Wilmington, where the amount of revenue collected during the year ending December 31, 1893, was $12,686. The nearest fort and light-house are, respectively, Fort Delaware and the Delaware Breakwater Light.

APPROPRIATIONS.

Act of—		Act of—	
July 15, 1870	$225,000	June 14, 1880	$10,000
June 23, 1874	10,000	March 3, 1881	10,000
March 3, 1875	25,000	August 2, 1882	13,000
March 3, 1875	15,000	April 4, 1890	10,000
August 14, 1876	30,000		
June 18, 1878	20,000	Total	378,500
March 3, 1879	10,500		

EXPENDITURES.

Total to June 30, 1894	$378,000

Money statement.

Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	$7,810.00

G 7.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

The Delaware Breakwater in its present condition consists of two detached structures of random stone rising about 13½ feet above high water, called, respectively, the breakwater and the ice-breaker. These structures were formerly separated by a gap about 1,350 feet in length.

The present project for the improvement contemplates the closing of the gap by the construction of a connecting breakwater. The project as originally adopted in 1882 provided for a substructure of random stone having its upper surface 12 feet below mean low water, with a superstructure formed of concrete in place. The project was modified in 1890 by establishing the level of the upper surface of the substructure at 15 feet below mean low water, and providing for the construction of the superstructure of concrete blocks. It was again modified in 1891, and now provides for the closing of the gap by the deposition of random stone, so as to raise the structure to a height of 14 feet above the plane of low water, with a width at top of 20 feet; the width at low water to be 40 feet and the slopes below this plane to be such as may be formed by the action of the sea; between low water and the top, the slopes to be about 1 on 0.7, formed by heavy stone laid in position.

During the fiscal year ending June 30, 1893, $18,746\frac{210}{2240}$ tons of stone were deposited in the gap. By this work the structure in the gap was raised to low water over its full length.

The total quantity of stone deposited under the present project is 154,481 gross tons.

The stone placed in the work during the last three fiscal years was deposited over a width of 40 feet, measured transversely to the axis of the gap between established lines so as to bring the structure to the level of low water over the entire area and permit the slopes to be formed naturally under the action of the sea.

An examination made during the past fiscal year shows that there has been very little settlement of the mass; that the sea face has assumed an average slope of 1:1.73, and the harbor face an average of 1:1.27.

Should funds become available it is proposed to apply them to the construction of the superstructure and the strengthening of the slopes if necessary.

The increase in the dimensions of vessels since the present harbor was designed in 1822, and the shoaling which has ensued behind the breakwater, render the harbor in its present condition inadequate to the requirements of commerce. Upon the completion of the present project of closing the gap, additional anchorage area will be added to the harbor, and it is probable that the shoaling will cease and the anchorage be deepened.

Under favorable conditions the work can be completed in a single working season. Its immediate completion is urgently necessary since the substructure in its present condition is a serious danger to navigation, being invisible at the higher stages of the tide. Two vessels have been totally wrecked upon it and several others have been severely injured. It has been found impossible to mark it in such way as to insure the safety of coasting vessels. The appropriation of the whole amount necessary for the completion of the work is therefore recommended.

The Maritime Exchange of Philadelphia maintains a station on the breakwater, and through telegraph cables between the mainland and their station are in connection with the shipping of the harbor. The reports of the maritime exchange state that during the year 1893 2,397 vessels, exclusive of tugs, fishing, and small coasting craft, anchored under the protection of the breakwater.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1893, was $12,686. Fort Delaware is the nearest fort and the Breakwater Light the nearest light-house.

APPROPRIATIONS.

Act of—		Act of—	
May 7, 1822	$22,700.00	August 30, 1852	$30,000.00
May 23, 1828	250,000.00	June 23, 1866	107,910.00
April 23, 1830	162,000.00	March 2, 1867	109,493.70
March 2, 1831	208,000.00	August 2, 1882	125,000.00
July 3, 1832	270,000.00	July 5, 1884	75,000.00
March 3, 1833	270,000.00	August 5, 1886	56,250.00
June 28, 1834	270,000.00	August 11, 1888	100,000.00
March 3, 1835	100,000.00	September 19, 1890	80,000.00
July 2, 1836	100,000.00	July 13, 1892	50,000.00
July 4, 1836 (survey)	1,000.00		
March 3, 1837	111,000.00	Total	2,678,353.70
July 7, 1838	150,000.00		

Total amount appropriated under present project to June 30, 1894	$486,250.00

EXPENDITURES.

Total to June 30, 1894	$2,678,301.14
Total under present project to June 30, 1894	486,197.44

Money statement.

July 1, 1893, balance unexpended	$162.44
June 30, 1894, amount expended during fiscal year	109.88
July 1, 1894, balance unexpended	52.56
Amount (estimated) required for completion of existing project	270,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	270,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

G 8.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

The Rancocas River discharges into the Delaware River at a point opposite the northern limits of the city of Philadelphia and about 12 miles above the foot of Market street. The project for its improvement was made in 1881, and proposed the formation of a channel from 150 to 200 feet wide with a low-water depth of 6 feet from its mouth to Centerton, a distance of about 7½ miles, and from thence to Mount Holly, a 5-foot low-water channel. The estimated cost of the improvement was $81,236.

Between 1881 and 1884, $20,000 was expended in the improvement of Coats Bar, the most serious obstruction on the lower river. In 1891 and 1892, $10,000 was expended in the formation of a channel 6 feet deep at mean low water and about 100 feet wide at localities between the mouth and Centerton; in the removal of three wrecks lying between the railroad bridge at Delanco and the junction of the Lumberton and Mount Holly branches of the river; and in the formation of a channel 25 feet wide and 4 feet deep at mean low water through the shoal areas between Centerton and Mount Holly, N. J.

During the fiscal year ending June 30, 1893, 19,936 cubic yards of material were removed from the channel by dredging.

At the close of the fiscal year ending June 30, 1893, the condition of this improvement was as follows: A low-water channel 100 feet wide and 6 feet deep had been formed through the shoal areas between the mouth of the river and Centerton. In this channel there has been some shoaling, but the dimensions appear to be sufficient for the present necessities of navigation. A low-water channel 50 feet wide and 5 feet deep had been formed above Centerton for a distance of about three-fourths of a mile, and a low-water channel 25 feet wide and 4 feet deep from thence to Mount Holly. The upper part of this channel has shoaled, so that its average depth is now about 3 feet. By this work about three-sevenths of the projected improvement has been completed.

No work was in progress during the past fiscal year, the expenditures being confined to office expenses.

This work is situated in the collection district of Burlington, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1893. The nearest fort is Fort Mifflin, and the Horseshoe Lights are the nearest light-houses.

APPROPRIATIONS.

Act of—	
March 3, 1881	$10,000.00
August 2, 1882	10,000.00
September 19, 1890	10,000.00
July 13, 1892	5,000.00
Total	35,000.00

EXPENDITURES.

Total to June 30, 1894	$34,860.32
Carried to the surplus fund in July, 1890	100.09

Money statement.

July 1, 1893, balance unexpended	$154.78
June 30, 1894, amount expended during fiscal year	115.19
July 1, 1894, balance unexpended	39.59

Amount (estimated) required for completion of existing project	$46,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	12,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1892 and 1893.

Kind of vessels.	Arrivals.				Departures.			
	1892.		1893.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Steamers	490	101,587	550	77,000	490	101,587	550	77,000
Sailing vessels	1,820	95,677	1,600	76,000	1,820	95,677	1,600	76,000
Barges	971	154,730	1,030	257,500	971	154,730	1,030	257,500
Canal boats	1,648	128,962	1,260	151,200	1,648	128,962	1,260	151,200
Total	4,929	480,956	4,440	561,700	4,929	480,956	4,440	561,700

Freight statement.

Articles.	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
ARRIVING.				
Chemicals	2,520	$75,600	5,700	$42,750
Coal	15,370	61,480	15,000	52,500
Lime	4,500	18,750	9,000	27,000
Lumber	1,133	15,450	825	12,000
Manure	24,000	18,000	30,000	45,000
General merchandise	5,650	339,000	12,000	600,000
Total	53,173	528,280	72,525	779,250
DEPARTING.				
Chemicals	1,500	45,000	....	....
Molding sand	138,600	210,000	90,000	135,000
Produce	3,000	180,000	2,700	126,000
Canned goods	1,500	60,000	833	45,000
General merchandise	6,760	234,000	8,500	340,000
Total	151,360	729,000	102,033	646,000

G 9.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

The river and harbor act of September 19, 1890, contained an appropriation of $6,000 for the improvement of Alloway Creek, New Jersey. This was the first appropriation made for the work.

Alloway Creek discharges into the Delaware River at a point 7 miles below Fort Delaware. Before improvement its channel had a natural mean low-water depth of more than 6 feet, extending 3½ miles above its mouth. Between this point and Quinton, a distance of 6½ miles, there were nine bars, with minimum depths at mean low water of from 1.3 to 4 feet.

The project for its improvement was based upon a survey made in 1889, and proposed the improvement of the stream between Quinton, N. J., and its mouth, a distance of 10½ miles, by the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above the Upper Hancock bridge;

from thence a channel of the same depth and 75 feet wide to the lower side of the bar at the Square. At a locality in the creek known as the Canal, in addition to obtaining a channel of the dimensions above named, the width of the stream is to be increased to about 150 feet between its low-water lines. At the Square the dredged channel is to be supplemented by a deflecting dike about 500 feet in length, formed of the material dredged from the adjacent bar, with its channel face protected by a riprap of stone. The estimated cost of the work was $25,000.

During the years 1891 and 1892, 23,234 cubic yards of material were removed by dredging from the shoal areas at the Square, Canal, and Upper Hancock bridge, at a cost of $4,182.12.

During the fiscal year ending June 30, 1893, 15,000 cubic yards of material were removed from the shoal areas between the Square and Hancock bridge above the Canal, and just below Upper Hancock bridge.

The work already done has produced channels from 40 to 75 feet wide and 6 feet deep at mean low water through the worst bars at localities known as the Square, Canal, and Upper Hancock bridge, whereby about one-third of the work projected has been accomplished and navigation much improved.

No work was done during the past fiscal year, the expenditures being confined to office expenses.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1893. The nearest fort is Fort Delaware, and the Reedy Island Light is the nearest light-house.

APPROPRIATIONS.

Act of—

September 19, 1890	$6,000.00
July 13, 1892	3,000.00
Total	9,000.00

EXPENDITURES.

Total to June 30, 1894	$8,929.12

Money statement.

July 1, 1893, balance unexpended	$179.00
June 30, 1894, amount expended during fiscal year	108.12
July 1, 1894, balance unexpended	70.88
Amount (estimated) required for completion of existing project	16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	16,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1892 and 1893.

Kind of vessels.	Arrivals.				Departures.			
	1892.		1893.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Steamers	70	7,350	70	7,350	70	7,350	70	7,350
Sailing vessels	40	4,000	40	4,000	40	4,000	40	4,000
Barges			70	10,500			70	10,500
Canal boats	70	10,500			70	10,500		
Total	180	21,850	180	21,850	180	21,850	180	21,850

Freight statement.

Articles.	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
ARRIVING.				
Coal	12,000	$40,000	8,500	$28,300
Glass sand	2,500	3,700	1,500	2,250
Tin plate	1,564	110,000	1,800	116,000
Lumber	4,800	50,500	3,500	36,750
Soda ash	525	15,000	200	12,000
Oystershells	2,143	5,000	2,500	5,500
Merchandise	7,500	225,000	7,000	200,000
Miscellaneous	2,109	47,400	2,000	40,000
Total	33,141	496,600	27,000	440,800
DEPARTING.				
Glass	2,480	150,000	2,000	120,000
Canned goods	1,488	400,000	1,480	400,000
Ship timber	250	5,000	200	4,000
Grain and farm produce	3,348	75,000	3,340	70,000
Miscellaneous			1,000	5,000
Total	7,566	630,000	8,020	599,000

G 10.

IMPROVEMENT OF SALEM RIVER, NEW JERSEY.

This river discharges into the Delaware River by its natural mouth about 4 miles below Fort Delaware. At a point in the Delaware River, about 10 miles above the natural mouth of the Salem River, a canal was constructed in 1872, by private enterprise, which connects with the Salem River at the point of its nearest approach to the Delaware. Just below the junction of this canal with the Salem River a dam was built dividing the stream into two parts; a lower part, from the natural mouth to the dam, and an upper part, from the mouth of the canal to the headwaters of the river. These parts are now essentially two independent streams.

The existing project, which provides for the improvement of the Upper Salem River, was adopted in 1881. It contemplated the removal of a shoal near Biddle's Landing, over which there was a depth of from 3 to 5 feet at mean low water, and which was the main obstruction between the head of the canal and Course's Landing. The estimated cost was $4,500.

The work done in 1881 and 1882 resulted in the formation of a channel 60 feet wide and from 6 to 7 feet deep at mean low water from the head of the canal to a point about 200 feet above Biddle's Landing, leaving about 700 feet to be improved to reach deep water below Hoxie's Landing. It was then found that since the original examination in 1878 the shoals had largely increased, and it was estimated that from $4,000 to $6,000 would be required for the completion of the improvement.

The sum of $1,500 was appropriated in the river and harbor act of 1882 for the continuation of the improvement, but the smallness of the amount rendered the proposals for dredging excessive, and further work having been postponed the remaining balance of $1,490.66 was passed to the surplus fund in 1890. Until the past fiscal year no work had been executed in the Upper Salem River since 1882.

During the fiscal year ending June 30, 1893, a survey was made of the Upper Salem River between the canal and Hoxie's Landing. This survey showed that since 1882 there had been extensive shoaling in the improved channel and above it. In the improved channel the low-water depth had decreased from 6 or 7 feet to about 3.5 feet. Between the improved channel and Hoxie's Landing the low-water depth had decreased from about 6 feet to about 3.5 feet. The minimum low-water depth in the lower part of the canal was about 4 feet, and the low-water depth over the bar at the mouth was less than 3 feet.

Under date of December 21, 1892, contract was entered into with Frank C. Somers, of Camden, N. J., for deepening the channel between the head of the canal and Hoxie's Landing by the removal by dredging of about 5,000 cubic yards of material, scow measurement. This work was completed on August 30, 1893, by the aggregate removal of 5,600 cubic yards of material. At the completion of this work the condition of the improvement was as follows: A low-water channel 6 feet deep and 50 feet wide had been formed above deep water at the head of the canal for a distance of 1,100 feet toward Hoxie's Landing. By this work about two-thirds of the projected improvement has been completed.

The estimated cost of redredging a channel 50 feet wide and 6 feet deep at mean low water from deep water at the head of the canal to deep water below Hoxie's Landing was $4,200, but this estimate is very uncertain, owing to the unusual conditions attending the work. It is believed that the improvement will be temporary.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1893. The nearest fort is Fort Delaware, and the Reedy Island Light is the nearest light-house.

APPROPRIATIONS.

For lower part of the river.

Act of—	
March 3, 1871	$4,000.00
June 18, 1878	3,000.00
June 14, 1880	3,000.00
Total	10,000.00

EXPENDITURES.

Total to June 30, 1883	$10,000.00

APPROPRIATIONS.

For upper part of river, present project.

Act of—	
March 3, 1881	$3,000.00
August 2, 1882	1,500.00
July 13, 1892	2,500.00
Total	7,000.00

EXPENDITURES.

Total to June 30, 1894	$5,462.73
Carried to surplus fund in 1890	1,490.66

Money statement.

July 1, 1893, balance unexpended	$2,396.41
June 30, 1894, amount expended during fiscal year	2,349.80
July 1, 1894, balance unexpended	46.61

Amount (estimated) required for completion of existing project	$1,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,700.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the year ending December 31, 1893.

Kind of vessels.	Arrivals.		Departures.	
	No.	*Tons.*	*No.*	*Tons.*
Steamers	350	12,500	350	12,500
Sailing vessels	120	3,600	120	3,600
Barges and canal boats	100	10,000	100	10,000
Total	570	26,100	570	26,100

Freight statement.

Articles.	Gross tons.	Value.
ARRIVING.		
Clay	350	$8,750
Coal	9,335	32,000
Groceries and provisions	1,400	245,000
Iron, pig	1,200	19,000
Lumber and wood	1,275	18,500
Manure	500	1,000
Sand	5,000	5,750
Soda ash	1,330	34,000
Miscellaneous	2,400	188,000
Total	22,790	552,000
DEPARTING.		
Canned goods	4,200	200,000
Fruits and vegetables	900	15,000
Grain	800	3,500
Hay and straw	500	5,000
Glass, manufactured	3,300	160,000
Iron, manufactured	1,400	36,000
Total	11,100	419,500

G 11.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

Goshen Creek rises in the central part of Cape May County and discharges into Delaware Bay about 15 miles north of Cape May. The project for its improvement was adopted in 1891. It contemplates the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing to a low-water depth of 3 feet and a width of 30 feet, the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth and out to the limit of the sand formation beyond the low-water shore line, and the protection of the dredged channel by a sheet-pile jetty on the south side of the channel extending about 600 feet outside of the low-water line of the bay. The object of the improvement is to provide navigable mean low water for vessels plying between Goshen Landing and Delaware Bay. The estimated cost is $12,000.

At the time of the adoption of the present project the channel of this creek had a low-water depth of from 2 to 4 feet, with a minimum low-water width of 20 feet and a high-water width of 36 feet, from Goshen to a point about 4,000 feet below; and from thence to the mouth, a distance of about 2,500 feet, a low-water channel from 3 to 5 feet deep with a least width of 30 feet. The work of improvement was commenced during the fiscal year ending June 30, 1893.

Under date of October 13, 1892, contract was entered into with Mr. Frank C. Somers for the removal by dredging of about 13,500 cubic yards of material from the creek below Goshen Landing. This work was completed on June 27, 1893, by the aggregate removal of 15,770 cubic yards of material.

At the close of the fiscal year ending June 30, 1893, the condition of this improvement was as follows: A low-water channel 3 feet deep and 30 feet wide had been formed below Goshen Landing for a distance of 3,975 feet. By this work about one-fourth of the projected improvement has been completed, and the navigable conditions have been proportionately improved.

No work was done during the past fiscal year, the expenditures being confined to office expenses.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1893. The nearest fort is Fort Delaware, and the Maurice River Light is the nearest light-house.

APPROPRIATIONS.

Act of July 13, 1892	$3,000.00

EXPENDITURES.

Total to June 30, 1894	$2,976.86

Money statement.

July 1, 1893, balance unexpended	$229.84
June 30, 1894, amount expended during fiscal year	206.70
July 1, 1894, balance unexpended	23.14
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	9,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1892 and 1893

Kind of vessel.	Arrivals.				Departures.			
	1892.		1893.		1892.		1893	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Sailing vessels	850	12,750	325	7,225	850	12,750	325	7,225

Freight statement.

Articles.	1892.		1893.	
	Gross tons.	Value.	Gross tons.	Value.
ARRIVING.				
Coal	1,000		429	$2,040
Lumber	1,200		215	4,300
Lime			1,200	7,460
Brick			120	2,500
Fertilizer	25		60	2,160
Grain	1,600		300	6,729
General merchandise	1,200		700	87,500
Total	5,025		3,024	112,689
DEPARTING.				
Sand			4,000	4,500
Fertilizer			300	1,500
Hay	200		750	3,750
Wood	6,000		575	5,750
Potatoes	120		325	7,200
Oysters	1,500		1,200	25,000
Clams			375	5,100
Grain			200	4,486
General merchandise			350	43,750
Total	7,820		8,075	101,036

G 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During the past fiscal year six wrecks have been removed under the authority of the act of Congress approved June 14, 1880.

In May, 1893, the 3-masted schooner *Booth Brothers* was sunk on Brigantine Shoal, New Jersey, about 3½ miles east from the South Brigantine Life-Saving Station. The wreck being a dangerous obstruction to vessels engaged in the coasting trade, its removal was recommended. Under date of August 9, 1893, a contract was entered into with Kelly & Van Sant for the removal of the wreck for the sum of $785. The work was completed on September 21, 1893.

In May, 1893, the canal boat *General Grant* was sunk in the channel of the Delaware River about 950 feet off the foot of Bridge street, Bridesburg, Pa. The wreck being a dangerous obstruction to vessels navigating the river above Philadelphia its removal was recommended. Under date of August 9, 1893, a contract was entered into with Kelly & Van Sant for the removal of the wreck for the sum of $327. The work was completed on September 2, 1893.

In February, 1893, a portion of an unknown wrecked vessel, about 30 feet long and from 12 to 15 feet in width, which was supposed to have lodged on the beach just north of Barnegat Inlet, New Jersey, several years ago, was driven during a storm into the bay and was found lying in the channel opposite Barnegat Light. The wreck being a dangerous obstruction to coasting vessels frequenting its vicinity, its removal was recommended. Under date of August 31, 1893, a contract was entered into with Torrance & Idell for the removal of the wreck for the sum of $145. The work was completed on September 10, 1893.

In June, 1893, the schooner *Kent* was sunk in the harbor of Philadelphia on the bar about 1,600 feet above the head of Smith Island, and was lying in water about 6 feet deep at mean low water. The wreck being a dangerous obstruction to vessels frequenting its vicinity its removal was recommended. Under date of October 23, 1893, a contract was entered into with Frank C. Somers for the removal of the wreck for the sum of $187. The work was completed October 25, 1893.

In November, 1892, the side-wheel steamer *Maryland* took fire and sank in the Schuylkill River, Pennsylvania, below Point Breeze. The wreck was found lying against the slope of the left bank of the river about 900 feet below the wharf of the Girard Storage Company. Efforts were made by interested persons to raise and beach the vessel, but they were unsuccessful, and it had twice slid down into the channel. The wreck being a dangerous obstruction to the large tank steamers navigating the river its removal was recommended. Under date of December 19, 1893, a contract was entered into with Kelly & Van Sant for the removal of the wreck for the sum of $744. The work was completed on March 24, 1894.

In June, 1893, the canal boat *Enterprise* was sunk on the northern edge of the channel in the Delaware River at the entrance to Salem River, New Jersey, in water about 7 feet deep at mean low water. The sternpost and 25 timbers on the port bow were found to be projecting about 3 feet above the surface at low water. The wreck being a dangerous obstruction to vessels passing in and out of Salem River its removal was recommended. Under date of January 9, 1894, a contract was entered into with Kelly & Van Sant for the removal of the wreck for the sum of $185. The work was completed on March 2, 1894.

In December, 1893, the schooner *Mount Vernon* with a cargo of hay was burned and sunk in Maurice River Cove, Delaware Bay. The wreck was lying directly in the path of vessels passing in and out of Maurice River from and to the upper Delaware River, and being a dangerous obstruction to navigation its removal was recommended. The wreck will be removed during the fiscal year ending June 30, 1895.

The amount expended during the year upon the removal of wrecks is $3,262.93.

Abstract of proposals for removal of the wreck of the schooner Booth Brothers, lying off Brigantine Shoal, New Jersey, opened August 1, 1893, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Charles W. Johnston and Enoch Townsend, Somers Point, N. J	$965
2	D. A. Johnston and E. G. Idell, Camden, N. J	1,100
3	Chapman Derrick and Wrecking Company, Brooklyn, N. Y	4,900
4	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	785

Contract (dated August 9, 1893) entered into with Kelly & Van Sant.

Abstract of proposals for removal of the wreck of the canal boat General Grant, lying in Delaware River off the foot of Bridge street, Bridesburg, Pa., opened August 1, 1893, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	John Cather, Philadelphia, Pa	$1,897
2	Frank C. Somers, Camden, N. J	383
3	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	227
4	H. G. Torrance, Philadelphia, Pa., and E. G. Idell, Camden, N. J	370
5	Joseph D. Truxton, Lewes, Del	994
6	Charles W. Johnston and Enoch Townsend, Somers Point, N. J	435

Contract (dated August 9, 1893,) entered into with Kelly & Van Sant.

Abstract of proposals for removal of a portion of a wrecked vessel lying in the channel opposite Barnegat Light, New Jersey, opened August 21, 1893, by direction of Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Charles W. Johnston and Enoch Townsend, Somers Point, N. J	$275
2	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	223
3	D. A. Johnston, Camden, N. J	225
4	H. G. Torrance, Philadelphia, Pa., and E. G. Idell, Camden, N. J	145

Contract (dated August 31, 1893) entered into with Torrance & Idell.

Abstract of proposals for removal of the wreck of the schooner Kent, lying in the Delaware River on Smith Island Bar, opened October 18, 1893, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	H. G. Torrance, Philadelphia, Pa., and E. G. Idell, Camden, N. J	$319
2	Frank C. Somers, Camden, N. J	187
3	Charles W. Johnston and Enoch Townsend, Somers Point, N. J	321
4	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	245

Contract (dated October 23, 1893) entered into with Frank C. Somers.

Abstract of proposals for removal of the wreck of the steamer Maryland, lying in Schuylkill River, Pennsylvania, below Point Breeze, opened October 28, 1893, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Charles W. Johnston and Enoch Townsend, Somers Point, N. J	$1,935
2	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	744

Contract (dated December 19, 1893) entered into with Kelly and Van Sant.

Abstract of proposals for removal of the wreck of the canal boat Enterprise, lying in the Delaware River, near the mouth of Salem River, New Jersey, opened January 3, 1894, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Frank C. Somers, Camden, N. J	$324
2	John Austin, Philadelphia, Pa	237
3	Cornelius J. Kelly and Gilbert M. Van Sant, Atlantic City, N. J	185
4	H. G. Torrence, Philadelphia, Pa., and E. G. Idell, Camden, N. J	267

Contract (dated January 9, 1894) entered into with Kelly and Van Sant.

Abstract of proposals for removal of the wreck of the schooner Mount Vernon, lying in Delaware Bay, off Egg Island Point, New Jersey, opened June 7, 1894, by Maj. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Frank C. Somers, Camden, N. J	$395
2	G. M. Van Sant, Atlantic City, N. J	564
3	Enoch Townsend, Somers Point, N. J	394
4	Duncan A. Johnston, New York, N. Y	220

Contract awarded to Frank C. Somers, but not yet entered into.

G 13.

ESTABLISHMENT OF HARBOR LINES FOR THE EASTERN OR UPPER PART OF THE PORT OF PHILADELPHIA, AND CERTAIN CHANGES IN LINES ALONG THE PHILADELPHIA WATER FRONT ESTABLISHED BY THE SECRETARY OF WAR UNDER DATE OF JANUARY 20, 1891.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., December 30, 1893.

GENERAL: The board of engineers, constituted by Special Orders, No. 20, Headquarters Corps of Engineers, dated February 25, 1889, having considered the location and establishment of harbor lines for the eastern or upper part of the port of Philadelphia, in compliance with the requirements of Department letter dated October 27, 1893, has the honor to submit the following report:

The board met at the U. S. Engineer Office, at Philadelphia, at 10 a. m. on November 23, 1893; present, all the members. At noon on the same day a public hearing was given, at the rooms of the Philadelphia Board of Trade, to afford an opportunity to interested persons to express their views. This meeting was previously advertised in the public press. On the same day the board visited and examined portions of the water fronts under consideration.

The board, in reports dated October 10, 1890, and January 2, 1891, described and recommended pier-head and bulkhead lines along the Camden water front from Kaighn Point to Cooper Point, and along the Philadelphia water front from Moore street to Otis street.

These lines were approved by the War Department on November 1, 1890 and January 20, 1891, respectively. In view of the rapid progress now being made in the work of improving Philadelphia Harbor, the board considers it desirable to extend the harbor lines on the Philadelphia front from Otis street to Harrison street, and on the opposite side of the channel from Cooper Point to Fishers Point.

Under the provisions of the sundry civil act of March 3, 1891, a new line, limiting the proposed excavation on Petty Island, was established on March 7, 1891. This change requires some readjustment of the lines already established between Vine and Otis streets.

A change in the location of the bulkhead line between Noble street and Green street, suggested by Messrs. Alexander Kerr, Bro. & Co., in their letter to the Secretary of War dated October 3, 1893, which letter was referred to the board for report by your indorsement dated October 5, 1893, has been considered and is recommended in this report.

The board recommends the establishment of the following-described pier-head and bulkhead lines, subject to the condition that wharves shall only be extended beyond the present legal port wardens' lines at such times and places as may be approved by the Secretary of War. These lines are shown in red on the two tracings transmitted herewith.*

PHILADELPHIA FRONT.

Description of pier-head line.—Beginning at a point in the pier-head line established by the Secretary of War, January 20, 1891, 750 feet from the west side of Delaware avenue on the prolongation of the south side of Poplar street, and running thence to a point on the prolongation of the west side of Shackamaxon street and distant 857 feet from the north side of Delaware avenue; thence to a point on the prolongation of the west side of Palmer street and distant 777 feet from the north side of Beach street; thence to a point 1,370 feet from and perpendicular to the north side of Bath street at a point 55 feet westerly from the west side of Ann street; thence to a point

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* Omitted.

977 feet from and perpendicular to the north side of Casper street at a point 95 feet easterly from the east side of Allegheny avenue; thence to a point 1,250 feet from and perpendicular to the north side of Delaware avenue at a point 280 feet westerly from the west side of Erie avenue; thence to a point on the prolongation of the east side of Butler street and distant 1,540 feet from the north side of Delaware avenue; thence to a point on the prolongation of the east side of Pike street and distant 1,690 feet from the north side of Delaware avenue; thence to a point on the prolongation of the east side of Luzerne street and distant 1,696 feet from the north side of Delaware avenue; thence to a point on the prolongation of the east side of Lewis street and distant 1,662 feet from the north side of Delaware avenue; thence to a point on the prolongation of the east side of Roxborough street and distant 1,582 feet from the north side of Delaware avenue; thence to a point on the prolongation of the east side of Harrison street and distant 1,460 feet from the north side of Delaware avenue; thence to the point C′ in the existing port wardens' line for the city of Philadelphia approved in 1886.

Description of bulkhead line.—Beginning at a point on the prolongation of the south side of Vine street and distant 150.75 feet from the west side of Delaware avenue, and running thence to a point 242 feet from and perpendicular to the west side of Delaware avenue at a point 85 feet southerly from the south side of Fairmount avenue; thence to a point 240 feet from and perpendicular to the north side of Delaware avenue at a point 152 feet westerly from the west side of Shackamaxon street; thence to a point 277 feet from and perpendicular to the north side of Beach street at a point 66 feet westerly from the west side of Palmer street; thence to a point 335 feet from and perpendicular to the west side of Beach street at a point 30 feet southerly from the south side of Plum street. Then beginning at a point 407.5 feet from and perpendicular to the west side of Beach street at a point 17.5 feet southerly from the north side of Plum street; thence to a point 685 feet from and perpendicular to the west side of Beach street at the intersection of the north side of York street with the west side of Beach street. Then beginning at a point 542.5 feet from and perpendicular to the west side of Beach street at a point 52.5 feet southerly from the south side of Cumberland street; thence to a point 780 feet from and perpendicular to the north side of Bath street at a point 20 feet easterly from the east side of Ann street; thence to a point 412.5 feet from and perpendicular to the north side of Casper street at a point 295 feet easterly from the east side of Allegheny avenue; thence to a point 680 feet from and perpendicular to the north side of Delaware avenue at a point 89 feet westerly from the west side of Erie avenue; thence to a point 955 feet from and perpendicular to the north side of Delaware avenue at a point 129 feet easterly from the east side of Butler street; thence to a point 1,091 feet from and perpendicular to the north side of Delaware avenue at a point 70 feet easterly from the east side of Pike street; thence to a point 1,096 feet from and perpendicular to the north side of Delaware avenue at a point 22.5 feet westerly from the east side of Luzerne street; thence to a point 1,070 feet from and perpendicular to the north side of Delaware avenue at a point 26 feet westerly from the west side of Lewis street; thence to a point 1,002.5 feet from and perpendicular to the north side of Delaware avenue at a point 85 feet westerly from the west side of Roxborough street; thence to the point C′ in the existing port wardens' line for the city of Philadelphia, approved in 1886.

CAMDEN FRONT.

Description of pier-head and bulkhead line.—Beginning at a point in the line of mean low water on the southwest side of Petty Island and running thence north 62° 16′ 28.88″ east, true bearing, to a point in the southern meadow bank of Petty Island, which point bears north 53° 53′ 49.96″ west, and is distant 134.18 feet from an iron pipe 2 inches in diameter, driven in the top of the southwestern meadow bank of Petty Island (this latter pipe bears north 58° 49′ 26.99″ west, true bearing, and is distant 1,063.31 feet from a pipe 2 inches in diameter driven in top of the southern meadow bank of Petty Island); thence, by a true course north 62° 16′ 28.88″ east, 4,763.05 feet to a point in the north side of Petty Island, which point bears north 0° 31′ 13.71″ east, and is distant 67.152 feet from an iron pipe 2 inches in diameter, driven in the ground on Petty Island; (this pipe bears north 23° 18′ 16.37″ east, and is distant 1,924.98 feet from a pipe 2 inches in diameter, driven in the top of the southeastern meadow bank of Petty Island); thence, by a true course north 73° 09′ 28.88″ east, 2,045 feet to a point on the north side of Petty Island, which point bears north and is distant 200 feet from an iron pipe 2 inches in diameter driven in the ground on the north side of Petty Island; thence to a point in the present bulkhead inclosing the head of Petty Island at the salient of the north side of said bulkhead, which point bears north and is distant 100 feet from an iron pipe 2 inches in diameter driven in the ground on Petty Island; thence to the northwest corner of the west end of the United States pile and stone dike, which extends out from Fishers Point, New Jersey; thence along the north side of the before-mentioned dike to a point distant 3,882 feet, measured along the north side of said dike from the northwestern corner of the west end of said dike; thence to a point which bears north 300 feet from a pipe 2 inches in diameter, and west 300 feet from another pipe 2 inches in diameter, both pipes driven in the ground at Fishers Point (the first pipe mentioned is about 30 feet back of the intersection of the north face of the United States dike with the shore); thence to a point which bears east 125 feet from an iron pipe 2 inches in diameter and north 30 feet from another pipe 2 inches in diameter, both pipes driven in the ground at Fishers Point.

The lines above described correspond to a channel width of 1,900 feet. In its report dated January 20, 1891, the board considered a change of channel-widths in the channel north of Petty Island from 2,000 to 1,900 feet to be undesirable, but as the projected width below Petty Island has since been established at 1,900 feet, the objections to this reduction of width no longer exist.

The letter of Messrs. Alexander Kerr, Bro. & Co. to the Secretary of War, dated October 3, 1893, is herewith respectfully returned.

Respectfully submitted.

WM. P. CRAIGHILL,
Colonel, Corps of Engineers.
C. B. COMSTOCK,
Colonel, Corps of Engineers,
Bvt. Brig. Gen., U. S. A.
C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 2, 1894.

Respectfully submitted to the Secretary of War.

The harbor line board for the port of Philadelphia, Pa., having considered the location and establishment of harbor lines for the eastern or upper part of the port of Philadelphia, submits the within report, recommending the establishment of the pier-head and bulkhead lines described therein and shown in red on the accompanying tracings. The board recommends that these lines be established subject to the condition that wharves shall only be extended beyond the present legal port wardens' lines at such times and places as may be approved by the Secretary of War.

Certain changes in lines established by the Secretary of War January 20, 1891, are proposed by the board, and the extent of these changes will be understood by reference to a tracing herewith.

I concur in the views of the board and recommend that the lines indicated be approved, and that the Secretary place his approval both upon this report and upon the tracings.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *January 5, 1894.*

The location of harbor lines as described in the within report is approved.

DANIEL S. LAMONT,
Secretary of War.

LETTER FROM MESSRS. ALEXANDER KERR, BRO. & CO., SUGGESTING CHANGE IN LOCATION OF BULKHEAD LINE BETWEEN NOBLE AND GREEN STREETS.

PIER 31 NORTH WHARVES, BELOW GREEN STREET,
Philadelphia, October 3, 1893.

DEAR SIR: Understanding the advisory board of engineers of the river and harbor improvement will convene in this city shortly to revise a portion of the harbor line, we would submit the inclosed plan * and ask for consideration.

As at present established the bulkhead causes the western line to take about 15 feet from the front of valuable improved properties and thus would entail a heavy loss on the city. The piers at this point are long and by moving the bulkhead, say 15 feet to the east, the western line will correspond with the house line and thus save heavy damages.

Yours, respectfully,

ALEX. KERR, BRO. & CO.

Hon. DANIEL S. LAMONT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 5, 1893.

Respectfully referred to Col. W. P. Craighill, Corps of Engineers, for consideration and report by the harbor line board for the port of Philadelphia.

To be returned.

By command of Brig. Gen. Casey:

H. M. ADAMS,
Major, Corps of Engineers.

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* Omitted.

APPENDIX H.

IMPROVEMENT OF RIVERS AND HARBORS IN DELAWARE, AND IN MARYLAND AND VIRGINIA EAST OF CHESAPEAKE BAY.

REPORT OF WILLIAM F. SMITH, UNITED STATES AGENT, MAJOR OF ENGINEERS, U. S. ARMY, RETIRED, IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Wilmington Harbor, Delaware.
2. Ice harbor at New Castle, Del.
3. Appoquinimink River, Delaware.
4. Smyrna River, Delaware.
5. Murderkill River, Delaware.
6. Mispillion River, Delaware.
7. Broadkiln River, Delaware.
8. Inland Waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.
9. Susquehanna River above and below Havre de Grace, Md.
10. Elk River, Maryland.
11. Fairlee Creek, Maryland.
12. Chester River, Maryland, from Crumpton to Jones Landing.
13. Choptank River, Maryland.
14. La Trappe River Maryland.
15. Warwick River, Maryland.
16. Cambridge Harbor, Maryland.
17. Broad Creek River, Delaware.
18. Wicomico River, Maryland.
19. Manokin River, Maryland.
20. Onancock Harbor, Virginia.
21. Harbor and approaches at Cape Charles City, Va.
22. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., July 7, 1894.

GENERAL: I have the honor to transmit herewith the annual report for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1894.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

At the beginning of the fiscal year the contract for dredging and removal of rock in this harbor entered into with the Atlas Dredging Company, of Wilmington, Del., was still in force and the work in progress, the time for completion of the contract having been extended under authority from the Chief of Engineers to October 1, 1893. The work had experienced much delay from the beginning. First, by ice during the preceding winter, and, later, by the hard material encountered in dredging and by injunctions served upon the contractors by the State authorities of New Jersey, who objected to the dumping of dredged material at certain points in the Delaware River, and by the consequent difficulty in finding a proper dumping ground. The time for completing the contract was further extended, after the first extension had expired, from October 1 to November 1, following. On that date the contractors, in view of the many disadvantages under which they were prosecuting the work, presented a request to have their contract terminated. The request was not granted by the Department; but a subsequent extension of three months until February 1, 1894, asked for was allowed them for the completion of the contract.

The removal of the ledge of rock below Third street bridge was completed during the latter part of September. The dredging operations in the upper part of the river continued until December 16, 1893, when the contract was finally closed. There were removed during the fiscal year under this contract 217 cubic yards of rock and 85,411 cubic yards of gravel, sand, mud, and clay, in about equal proportions, making the total removed under the principal and supplementary contracts 684 cubic yards of rock and 158,397 cubic yards of gravel, etc., measured in place. Of this quantity, 12,166 cubic yards of sand and mud were dumped in the river and then redredged and put ashore over the dike in front of the property of the Lobdell Car Wheel Company. The remainder was carried away in scows and dumped at the following places: 86,986 cubic yards along the eastern edge of the Cherry Island flats, Delaware River; 36,351 cubic yards in a cove of the west shore of Delaware River below Edgemore; and 22,894 cubic yards along the lower side of the dike at Bulkhead Shoal, Delaware River. The rock removed from both ledges at Third street bridge having been considerably broken up by blasting, was raised by a small grabble dredge and put in scows and, on the following high water, deposited along the north side of the jetty at the mouth of Christiana River.

The section of the channel improved during the fiscal year to a depth of 15 feet below mean low water extends from a point 75 feet east of Market street bridge to the pulp works, a distance of 4,370 feet measured along the center of the channel. Of this distance the lower portion, for a length of 2,590 feet, has been dredged to the full approved width of 150 feet, the following 820 feet for a width of 80 feet, and the remaining 960 feet for a width of 40 feet. This last cut reaches to the upper terminus of the present river improvements and what remains to be done to complete them under the present project is to widen this and the preceding narrow section to the full width of 150 feet and to build the extension of the jetty.

The approved project of improvement is for a 15-foot low-water channel 150 feet wide from the mouth of the Christiana River to the Rolling

Mill wharf, which is 4,750 feet above the outer end of the jetty; 100 feet wide from this wharf to the Delaware and Western Railroad bridge, and 75 feet wide from this bridge to the pulp works; also for a channel 12 feet deep and 50 feet wide from the pulp works to the Delaware Railroad bridge, and for the construction of a jetty 1,740 feet long on the north side of the mouth of the river. The Board of Engineers recommending these improvements in 1881 estimated the total cost at $175,551. The construction of the jetty and dredging operations were begun the following year. A revised estimate for the completion of the project was submitted in 1883. This estimate increased the channel width from the Rolling Mill wharf to the pulp works to 150 feet, and the final cost to $191,384, exclusive of the expense of the jetty, which was then nearly completed, and for the channel above the pulp works, which was stricken off. A modification of the plan of the jetty was made and approved in 1884, providing for an additional height of 4 feet and an extension of 322 feet. The former work was done the following year.

Up to the year 1871 the General Government had at various times expended $32,365 in the improvement of the Christiana River, now Wilmington Harbor. Between the years 1871 and 1881 improvements were carried on under a project for a 12-foot low-water channel from 100 to 200 feet wide. This project was completed in 1881, at a total expense of $83,500.

Under the project adopted in 1881, $215,840.21 had been expended up to the close of the fiscal year ending June 30, 1893. There was then an improved channel 15 feet deep at mean low water and 150 feet wide from the 15-foot depth outside the bar at the mouth to a point 75 feet east of Market street bridge, except over the rock below Third street bridge, the removal of which to 15 feet was then in progress.

The amount asked for, if appropriated, will be expended in completing the project.

Wilmington is a port of entry and in the collection district of Delaware. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved—		By act approved—	
July 14, 1836	$15,000	June 14, 1880	$10,000
March 3, 1837	8,000	March 3, 1881	50,000
July 7, 1838	9,356	By act passed August 2, 1882	50,000
July 11, 1870	15,000	By act approved—	
June 10, 1872	10,000	July 5, 1884	25,000
March 3, 1873	6,000	August 5, 1886	18,750
June 23, 1874	6,000	By act of August 11, 1888	30,000
March 3, 1875	10,000	By act approved—	
August 14, 1876	16,000	September 19, 1890	30,000
June 18, 1878	7,000	July 13, 1892	40,000
March 3, 1879	3,500		

Of the above the sum of $2,411.22 has been carried to the surplus fund of the Treasury.

Money statement.

July 1, 1893, balance unexpended	$27,909.79
June 30, 1894, amount expended during fiscal year	24,716.54
July 1, 1894, balance unexpended	3,193.25
Amount (estimated) required for completion of existing project	47,634.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	47,634.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The following statistics are furnished by William D. Mullen, jr., president of the Board of Trade of Wilmington, Del.

Products.	Capital.	Value of annual production.	Number of employés.
Iron and steel manufactures	$10,001,400	$13,042,800	7,280
Morocco and other leathers	2,336,800	5,422,250	2,274
Carriage, wagon and carriage woodwork	1,119,800	1,207,800	702
Cotton	2,556,750	2,352,000	1,974
Harness and other leather goods	75,900	121,000	46
Mill woodwork	493,350	718,175	517
Railroad cars	2,280,000	4,560,000	3,060
Flour and meal	504,850	756,700	89
Beer	540,000	660,000	126
Fertilizers	661,700	1,062,000	225
Bricks and terra cotta	247,250	356,500	350
Granite, quarried, and sandstone and marble worked	249,700	646,800	420
Pork-packing	108,000	384,000	72
Miscellaneous	7,120,960	713,782,725	3,095
Total	28,296,460	45,072,750	20,230

The tonnage of the leading articles received is estimated as follows:

	Tons.
Coal	300,000
Lumber	112,500
Iron	75,000
Sand	50,000
Cement	5,200
Plaster	500
Paper	45,000
Flour and meal	360,000
Machinery	75,000
Railroad cars	81,000
Granite stone	50,491
Groceries Dry goods Miscellneous	120,000
Total	1,274,691

There is invested in freight and passenger lines plying between this city and Philadelphia $1,000,000, making 10 departures and 10 arrivals daily of vessels of about 250 tons capacity running between Philadelphia and Wilmington.

The following statistics relating to foreign imports and exports and of vessels sailing and trading in Wilmington Harbor are furnished by the Hon. George L. Townsend, collector of customs, Wilmington, Del.:

Imports: Goat hides, nitrate of soda, etc	$221,270
Exports:	
Machinery (3,553 tons)	1,111,706
Crude and refined oils (47,938,955 gallons)	1,683,043
Total	3,016,019

Vessels trading in harbor at Wilmington, Del.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
		Tons.	*Feet.*	
Steamers	2	543	13	Two trips daily between Philadelphia and Wilmington.
Do	2	464	6 and 7	Three trips daily, passengers and freight.
Tugboats	5	1,594	4 to 8	In river and harbor work.
Do	3			Wilmington and Northern Railroad.

Numerous schooners and sloops are engaged in trade coastwise, carrying general merchandise, of which no record is kept.

The following statistics of vessels built and repaired at Wilmington, Del., were furnished by the Harlan & Hollingsworth Company, Jackson & Sharp Company, Pusey & Jones Company, and Enoch Moore, Wilmington, Del.:

Vessels built.

Class.	Number.	Tonnage.	Draft.
Passenger steamers:			*Feet.*
Wooden	4	479	5
Iron	1	28	5
Passenger and freight steamers:			
Wooden	2	300	7
Iron	1	143	5
Tugboats, wooden	3	292	5
Barges and scows	5	2,585	....
Total	16	3,827	....

Vessels repaired.

Class.	Number.	Tonnage.
Steamers	106	31,037
Sailing vessels	48	6,263
Total	154	37,300

H 2.

IMPROVEMENT OF ICE HARBOR AT NEWCASTLE, DELAWARE.

At the beginning of the fiscal year there was available of the appropriation of September 19, 1890, a balance of $3,583. A project was submitted to the Department to expend this sum in dredging the harbor, where needed, to a depth of 18 feet below mean low water, which was approved on August 16, 1893. It was estimated that to dredge the portion of the harbor up to the wharf line, which had a depth of less than 18 feet of water, would require the removal of about 32,000 cubic yards of material. In this area was included that portion which had been dredged in 1887 to a depth of 18 feet, but which had shoaled again about an average of 2 feet. Awaiting favorable prices in the dredging market, in order to accomplish if possible with the available funds the removal of the entire shoal, the work was let in December, 1893, under a verbal agreement to the Atlas Dredging Company, of Wilmington, Del., at the low price of 9.4 cents per cubic yard, measured in place.

Operations were begun on January 29, 1894, and were completed on February 28 following, 31,000 cubic yards of mud having been removed. The dredged material was carried away in scows and deposited on the lower side of the dike at Bulkhead Shoal in the Delaware River. The dredged area is somewhat irregular in shape, averaging 1,000 feet in length and 135 feet in width, and extends from a short distance above Pier O, at the upper end of the harbor, to Pier I, at the lower end, and to within 10 feet of the wharf line. At the close of operations the depth of water within the harbor was not less than 18 feet at mean low tide, but as the harbor has previously been dredged twice, to 12 and 18 feet respectively, and the water above and below the same along the shore is comparatively much shoaler, there is no probability that these improvements are permanent and periodical dredging will have to be resorted to, if the depth is to be maintained.

The project for the establishment of an ice harbor at Newcastle dates back to colonial times, and was suggested by the necessity of providing a place of refuge for vessels during the prevalence of ice in the Delaware River. Since the ice harbor at Reedy Island, 10 miles farther down the river, has become useless from decay and lack of water, this harbor is now the first one vessels reach in coming up the bay. The number of vessels seeking refuge during winter is very great, and the enlargement of the harbor is only a question of time. Attention was called in the report for 1892 to the practicability of materially enlarging the area of the harbor, by the construction of an additional pier on the 30-foot contour at the point of intersection of two lines prolonged over piers K and M and L and N, respectively.

The two outermost piers, M and N, are at present too far apart to shelter the harbor effectually against running ice when strong easterly winds prevail.

The project adopted in 1884 is now completed. It provided for the repair of Pier K, the placing of riprap around it and Pier N, and the rebuilding of Pier H; also, the increase of the area and depth of the harbor by dredging. The amount appropriated was $22,600. Up to the close of the fiscal year ending June 30, 1893, $19,017 had been expended on the project. As many of the ice piers, especially the older ones, are liable at any time to be damaged by ice or by collision with vessels, and may need immediate repairs, a small sum should be available to keep them in proper condition.

Newcastle is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved—		By act approved—	
May 20, 1826	$25,000.00	August 14, 1876	$12,000.00
March 2, 1829	17,895.99	June 18, 1878	10,000.00
July 2, 1836	25,000.00	March 3, 1879	5,500.00
March 3, 1837	10,000.00	June 14, 1880	3,000.00
July 7, 1838	11,573.00	March 3, 1881	20,000.00
August 30, 1852	15,000.00	July 5, 1884	2,000.00
July 15, 1870	2,500.00	August 5, 1886	5,000.00
June 10, 1872	27,000.00	By act of August 11, 1888	7,500.00
March 3, 1873	20,000.00	By act approved September	
June 27, 1874	10,000.00	19,1890	8,100.00
March 3, 1875	20,000.00		

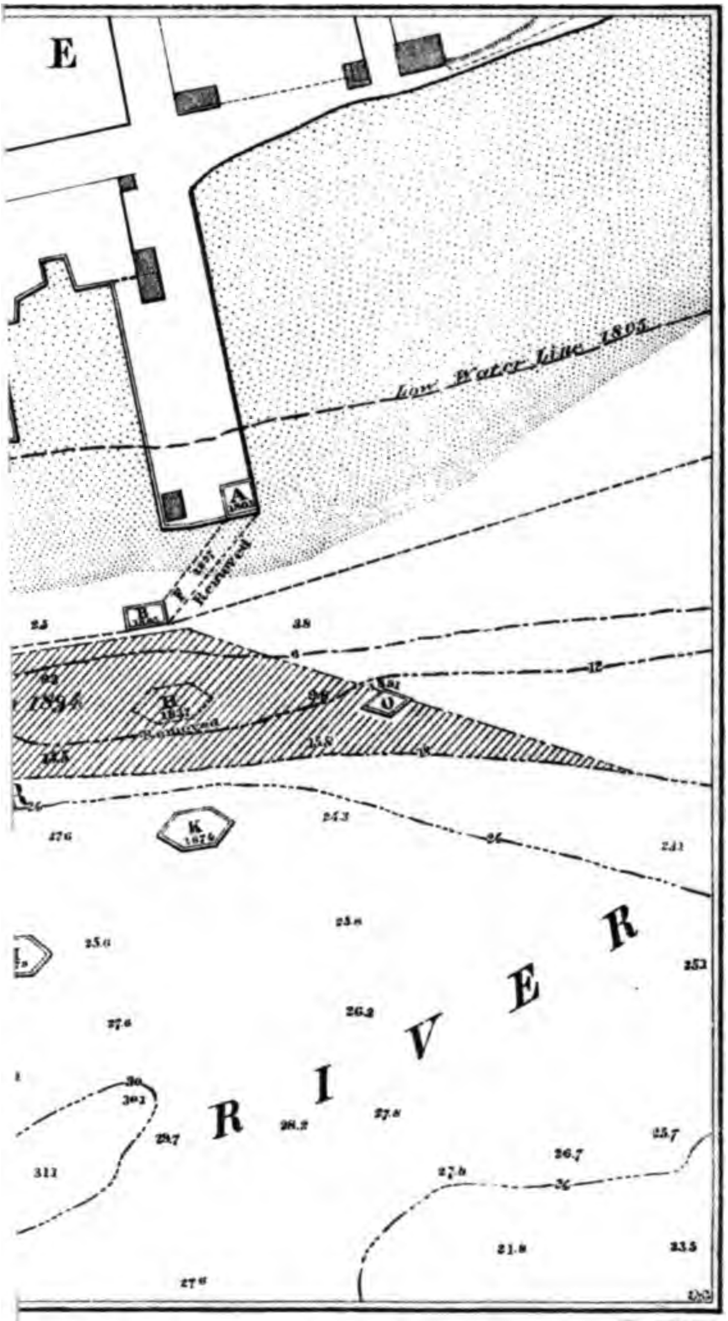
Of the above, the sum of $18,285.05 has been carried to the surplus fund of the Treasury.

Money statement.

July 1, 1893, balance unexpended	$3,583.00
June 30, 1894, amount expended during fiscal year	3,454.35
July 1, 1894, balance unexpended	128.65

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1893.

The following statistics, furnished by the Wilmington and Northern Railroad, show the business of that company to and from Newcastle, Del. The statistics in relation to vessels that have sought a refuge in this harbor were requested but not received.



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UNIV. OF MICH.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, plate and pig iron, and iron pipe	21,383	$407,250
Lumber, etc	21	150
Total	21,404	407,400
Shipments, iron pipe, scrap iron, etc	1,897	32,020
Total receipts and shipments	23,301	439,420

Vessels in service.

Class.	Number.	Aggregate tonnage.	Trips.
Tug	1	17	In constant service.
Tug	1	15	Do.
Barges	5	....	Do.

H 3.

IMPROVEMENT OF APPOQUINIMINK RIVER, DELAWARE.

Nothing was done on this river during the past fiscal year for want of funds.

At the time of the adoption of the present project there was a mean low water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and is for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa to near Townsend's Wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement is $39,963.

In 1891 the channel was dredged to the full width of 80 feet and depth of 8 feet at mean low water for a distance of 1,975 feet in a down-river direction, beginning at the lower end of Watkins Wharf at Odessa, and early in 1893 a further distance of 4,487 feet was dredged. Of the latter, 595 feet were dredged to the approved width; but on account of the settlement and sliding in of the very soft marsh banks upon which the excavated mud and sand were deposited, the full approved width of 80 feet could not be made along the remainder 3,892 feet, and it was therefore made of 50 feet until the banks should have become firmer. The entire length dredged is 6,462 feet, of which 2,570 feet are 80 feet wide and 3,892 are 50 feet wide. The channel has thereby been materially improved as far as the work has progressed, giving great relief to shipping and the harbor room at Odessa increased. The amount expended on this improvement to the close of the fiscal year 1893 was $10,000.

It is proposed to expend the amount asked for in continuing improvements as approved, in a down-river direction, beginning at the point where work was left off in 1893.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved September 19, 1890	$5,000
By act approved July 13, 1892	5,000

Money statement.

Amount (estimated) required for completion of existing project	$29,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, coal, iron, phosphate, etc	1,735	$9,925
Chemicals, fertilizers, canned goods, etc	3,966	62,960
Farm products, live stock, etc	243	15,250
General merchandise	3,445	191,250
Total	9,389	279,385
Shipments:		
Canned goods, fertilizers, hides, tallow, etc	2,950	162,000
Poultry, fruit, grain, live stock, etc	6,453	218,900
General merchandise	1,500	60,000
Total	10,903	440,900
Total receipts and shipments	20,292	720,285

Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	367	7	Service and tri-weekly.
Tug boats	3	135	7	150 to 200 trips each year.
Schooners	4	275	6	150 to 200 trips each year.

The above statistics were furnished by Hon. Columbus Watkins, Odessa, Del.

H 4.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

At the beginning of the fiscal year a contract dated October 26, 1892, was in force with Chester T. Caler, of Norfolk, Va., for dredging, at the rate of 13 cents per cubic yard, measured in place, the work to be completed before December 31, 1893.

Operations were begun on September 6, 1893, and completed on the 11th day of the following month, 19,593 cubic yards of material, principally mud, sand, and clay in about equal proportions, having been removed and deposited upon the banks of the river along the edge of the cut. Dredging was done at seven different localities, five being in the upper, one in the middle, and one in the lower section of the river. As the channel had previously been much improved, but nowhere to the full approved dimensions, the main object of the season's work consisted in giving it the required depth and width of 7 and 60 feet, respectively, where the needs of navigation should most demand it.

The first point improved extends from the upper granary, at Smyrna Landing, the head of navigation, to Sisco's Wharf below, a distance of about 1,100 feet. Except for a short distance at the point of beginning, the full width of the channel was made throughout this section and the depth increased to 7 feet below mean low water, including the area of the turning basin, which is located here. Proceeding down the river, the next point where dredging was done was near the Lewis & Price Phosphate Works. Opposite the works exists a very sharp turn in the river, and although the point which makes it had been cut back during previous operations, the difficulties experienced in making the turn by vessels going at full speed still remained to a great degree. The difficulty was much alleviated by dredging an additional width of about 25 feet for a distance of 400 feet into the concave shore of the bend, which increased the channel width opposite the point to an average of 75 feet. Beginning at Walravens Point, a section of the river, 1,870 feet long, was then dredged to full width and depth as far as the Beaver House Point. Between this point and the mouth of Old Creek, a short and somewhat sinuous reach of the river, the channel was widened at two places, 200 feet by 60 feet on the east side and 150 by 20 feet on the west side, respectively.

The last locality referred to is about 1½ miles below Smyrna Landing. The following 3½ miles of the river appeared to be in a fair condition, and no particular obstruction was reported to interfere with navigation above Gravel Reach, 5 miles below the landing. As the name indicates, at this point existed a hard gravel bar which had previously been dredged to a depth of 6½ feet; the channel, however, was narrow, and on account of a sharp turn at each end of the reach was difficult to make under full headway, especially on windy days. It was, therefore, redredged for its full length, 780 feet, the width being increased to 60 feet and the depth to 7 feet below mean low water.

Upon request of the steamboat company, a cut 50 feet wide and 7 feet deep through a narrow bar over which 5 feet of water could be carried at mean low tide, and which is located about one-half mile inside the mouth of the river, was also made before the close of operations, the number of cubic yards of material removed at this point being 222.

The existing project for improvement of this river, formerly Duck Creek, is based upon a survey made in 1887, and is for a 7-foot low water channel 60 feet wide from Smyrna Landing to the mouth, and 100 feet wide across the bar at the entrance, at an estimated cost of $37,365.20. The project was approved in 1888, and operations since then have been confined to the improvements within the upper river. Up to the close of the fiscal year ending June 30, 1893, $14,950.82 had been expended in improving the upper 5 miles of the river at various shoals and bars, the dredged channel being no less than 40 feet wide and 6½ feet deep at mean low water.

Previous to 1888 the General Government had expended $10,000 in improving the entrance to this river. Several cut-offs, to straighten the course of the creek, were made many years ago by the citizens of Smyrna, at an expense of $6,500.

With the amount expended during the past fiscal year 4,730 feet of the channel were completed in accordance with the project, the total length to be improved being 25,425 feet. As this length was entirely dredged during previous seasons, but not to the full dimensions, there remain 20,695 feet of channel, now 40 feet wide and 6½ feet deep, to be widened to 60 feet and to be deepened to 7 feet below mean low water. No examination has been made of the improved channel since the close of operations last year, but it is believed to be in fair condition.

The improved channel has been the means of bringing navigation 2 miles nearer the town of Smyrna, resulting in a reduction in freight rates and in the time of transporting freight to and from the town.

The amount asked for, if appropriated, will be expended in dredging, in pursuance of the project now in force.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	3,000
By act passed August 2, 1882	2,000
By act of August 11, 1888	10,000
By act approved—	
September 19, 1890	5,000
July 13, 1892	3,000

Money statement.

July 1, 1893, balance unexpended	$3,049.18
June 30, 1894, amount expended during fiscal year	2,855.09
July 1, 1894, balance unexpended	194.09
Amount (estimated) required for completion of existing project	19,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, pig iron and steel, phosphate rock, etc	6,700	$88,000
Chemicals, canned goods, fertilizers, etc	8,513	207,000
Grain, wheat, cattle, fruits, etc	4,500	30,000
General merchandise	10,000	400,000
Total	29,713	725,000
Shipments:		
Cord-wood, railroad ties, timber, etc	80,900	209,000
Baskets, tile, terra cotta, canned goods, etc	106,740	557,000
Fruits, vegetables, grain, cattle, horses, etc	23,340	1,425,850
General merchandise	5,000	200,000
Total	215,980	2,391,850
Total receipts and shipments	245,693	3,116,850

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	1	160	5	Daily three months; three trips each week balance of year.
Do	3	450	6	Charter.
Tugs	3	....	6	In constant trade.
Barges	2	400	6	
Schooners	5	240	4 to 5	Charter.

Many small sloops and fishing vessels trading, and at times a number at mouth of river where there is a good harbor, but bar at mouth prevents large vessels entering.

The above statistics were furnished by Mr. A. E. Jardine, secretary of the Philadelphia and Smyrna Transportation Company, accompanied by the following letter:

SMYRNA, DEL., *May 2, 1894.*

DEAR SIR: We herewith mail you statistics as requested. Have made very few changes as the total volume is very little increased over the previous year. Since the last work there has been erected at Smyrna Landing three large factory buildings, one 130 by 60, part three stories; one 40 by 80, two stories, and one 110 by 45, one story. These factories have already about doubled the population of Smyrna Landing and employ in full season over 200 hands. There is no doubt but what these industries were started principally on account of the improved shipping facilities due to increase in depth and width of channel, and that more such factories will locate as soon as the work is completed at the mouth of the river. All large cargoes have now to be unloaded outside and lightered, owing to insufficiency of water at the mouth.

This company is still postponing the building of a new steamer, hoping that an appropriation will soon be made so that Smyrna River will be navigable at any tide. Trusting that this will meet your approval, we remain,

Yours, very truly,

A. E. JARDINE, *Secretary.*

Gen. WILLIAM F. SMITH.

H 5.

IMPROVEMENT OF MURDERKILL RIVER, DELAWARE.

At the beginning of the fiscal year work under a contract with Chester T. Caler, of Norfolk, Va., dated October 24, 1892, for dredging at the mouth of the river at the rate of 13 cents per cubic yard, measured in place, was in progress, operations having been begun on the 28th of the preceding month. The work was completed on August 31, following, 45,454 cubic yards of material having been removed during the fiscal year. The total amount of material removed under the contract is 47,804 cubic yards. The excavated material, which consisted of sand, shells, gravel, and black mud in about equal proportions, was deposited along the sides of the cut made by the dredge. A channel was dug to a depth of 5 feet below mean low water across the flats from a point a short distance inside the mouth of the river to the 5-foot depth in Delaware Bay, its width being 60 feet and its length 4,840.

The present project for improvement is based upon a survey of the river made in 1891, and is for a 7-foot low-water channel 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, and 150 feet wide from the mouth across the flats outside to the 7-foot depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550. The project was adopted in 1892, an appropriation of $7,000 having been made by Congress under which the first work, as described above, was done during the fiscal years ending June 30, 1893, and June 30, 1894. Very little progress had been made at the end of the first-named fiscal year, when the total expenditures amounted to $152.90.

In 1881 a survey of this river was made by the U. S. Engineer Department in accordance with the river and harbor act of March 3, 1881, and a project submitted for its improvement. No appropriation was subsequently made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

The total expenditures under the present project to June 30, 1894, were $6,976.22. No examination has been made of the cut since the suspension of the work in August last, and its present condition is therefore not known.

The amount asked for, if appropriated, will be expended in dredging at the bar.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1894, was $12,686.

AMOUNT APPROPRIATED.

By act approved July 13, 1892	$7,000

Money statement.

July 1, 1893, balance unexpended	$6,847.10
June 30, 1894, amount expended during fiscal year	6,823.32
July 1, 1894, balance unexpended	23.78
Amount (estimated) required for completion of existing project	40,550.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, rock phosphate, timber, etc	11,100	$203,000
Chemicals, mill work, lime, etc	12,795	109,240
Cattle, fruit, vegetables, etc	1,871	48,180
General merchandise	6,500	260,000
Total	32,266	620,420
Shipments:		
Logs, railroad ties, timber, etc	51,320	228,400
Canned goods, fertilizers, tin plate, etc	6,555	325,975
Fruit, grain, cattle, sheep, etc	18,575	792,010
General merchandise	820	32,800
Total	77,270	1,379.185
Total receipts and shipments	109,536	1,999,605

Vessels trading in Murderkill River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	75	6½	Semiweekly.
Sloops	2	24	4½	
Schooners	6	300	5 to 6	Constantly engaged in trade.

The above statistics were furnished by Mr. Caleb J. Smithers, Frederica, Del.

H 6.

IMPROVEMENT OF MISPILLION RIVER, DELAWARE.

At the beginning of the fiscal year dredging operations had been suspended under authority from the Department received June 21, 1893, on account of the difficulties encountered in dredging a channel across the shoals within the entrance to the river. The suspension was granted until some works could be devised to protect the cut to be made and to prevent its being filled up again by the strong cross tides. A plan for a dike, consisting of two rows of closely driven piles 6 feet apart and strengthened with wale pieces and cross-ties, the space between the piles to be filled with brush and the outside of the dike to be revetted with dredged material to the top of the piling, was submitted and returned approved on July 3, 1893. The amount reserved for that purpose from the appropriation was $5,000. Proposals were immediately invited by circular letter sent to six responsible firms and in reply three bids were received of which the lowest, that of Sanford & Brooks, of Baltimore, Md., to build the dike as specified at the rate of $8.90 per linear foot complete, was accepted. The contract was approved by the Chief of Engineers under date of August 11, 1893, and the first pile was driven on the 30th day of the same month. On October 27 following, 500¾ feet of dike, as much as could be built under the allotment, were completed and the contract was closed.

The dike, which is to contract the present wide mouth of the river and to regulate the course of the in and outgoing tide so as to concentrate it in one direction, begins above high-water mark on Sandy Point, on the north side of the entrance, and extends 395 feet in a straight line due south; then deflects 17¼° east for the remaining length, 105¾ feet, as far as it is built at present. It is proposed to extend it further on this line when additional funds become available.

Dredging operations were resumed in the immediate vicinity of the dike on October 20. As the flats are nearly bare at low tide, the work could most of the time be carried on only during high water. The first cut was begun inside the mouth of the river, on the same side and a short distance above Sandy Point. This point, which projects into the main channel, was cut back as much as the safety of the bank of sand thrown up by the dredge would permit. A channel was made about 570 feet long, 80 feet wide, and 5 feet deep at mean low water from the 5-foot depth in the creek to a point opposite and 50 feet west from the outer end of the dike, the direction being the same as that of the second section of the latter. The contract was completed on November 30, 1893. During the fiscal year 23,500 cubic yards of material had been removed, making a total of 30,329 cubic yards removed under the contract. The improvements made so far at the mouth are too limited and too incomplete to have any effect upon the commerce of the river.

The present project for improvement is based upon a survey of the river made in 1891, and is for a cut across the flats, 150 feet in width and 6 feet in depth, at mean low water from inside the mouth of the river to the 6-foot contour in the bay, the dredged material to form a wall of mud on the northern side of the cut, the estimated cost being $24,000. The project was adopted in 1892, an appropriation of $12,000 having been made by Congress. Under authority received from the Chief of Engineers on July 3, 1893, the project was partly modified, by granting permission to strengthen the base or inshore end of the mud bank with a pile dike, filled with brush. The work done during the past fiscal year and during May and June, 1893, was the first done under the project.

Mispillion River, formerly Mispillion Creek, has been under improvement by the General Government since 1879, $17,000 having been expended before the present project was adopted in making a channel 40 feet wide and 6 feet deep at low water between Milford, at the head of navigation, and the mouth. This channel was completed with the exception of a short and shoal section near the mouth, which needs dredging.

At the close of the fiscal year ending June 30, 1893, $1,089.38 had been expended under the present project. The cut dredged to that date was 600 feet long, 40 feet wide, and 6 feet deep, and had undoubtedly partly filled again.

Further appropriations will be expended in continuing the execution of the project as begun.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1894, was $12,686.

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1879	$3,000
June 14, 1880	4,000
March 3, 1881	3,500
By act passed August 2, 1882	3,000
By act of August 11, 1888	3,500
By act approved July 13, 1892	12,000

Money statement.

July 1, 1893, balance unexpended	$10,910.62
June 30, 1894, amount expended during fiscal year	9,416.71
July 1, 1894, balance unexpended	1,493.91
Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals received and opened by Gen. Wm. F. Smith, United States Agent, for the construction of a dike filled with brushwood, at the mouth of Mispillion River, Delaware.

No.	Name.	Per linear foot.	Remarks.
1	Patrick Long & Co.	$9.20	
2	Delaware Construction Co	12.60	
3	Sanford & Brooks	*8.90	$7.50 per foot without filling in.

* Lowest; accepted at $8.90 per linear foot of dike, filled in with brushwood as per specifications.

Commercial statistics were asked for, but have not been received.

H 7.

IMPROVEMENT OF BROADKILN RIVER, DELAWARE.

There were no operations during the fiscal year ending June 30, 1894. The original project for improvement was made in 1871, and is for a 6-foot low-water navigation with a minimum width of 40 feet from the mouth of the river to Milton, the head of navigation, and for a new entrance protected by a jetty, at an estimated cost of $80,447. This project was modified in 1881 relative to the entrance, and the estimate reduced to $51,450. The channel within the river has been completed in accordance with the project at an expense of $35,000, which was the total amount expended at the close of the fiscal year ending June 30, 1893.

The amount required for completion of the existing project is for the improvements at the mouth of the river as designed in 1871 and modified in 1881. In view, however, of the projected location, only a few miles below the Broadkiln River, of the outlet for the inland waterway from Chincoteague Bay to Delaware Bay, a possibility has arisen that the Broadkiln can be connected with the waterway at much less cost and with greater advantage to both than if the existing project were carried out. It is recommended, therefore, for the present not to appropriate any money for a new entrance.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1873	$10,000
June 14, 1880	5,000
March 3, 1881	5,000
By act passed August 2, 1882	5,000
By act of August 11, 1888	10,000

Money statement.

Amount (estimated) required for completion of existing project	$21,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

H 8.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE BAY, AT OR NEAR LEWES, DELAWARE.

At the beginning of the fiscal year proposals for work to be done under the project authorizing the expenditure of the appropriation of $50,000, made September 19,1890, together with that of July 13, 1892, of $25,000, had been invited for the third time, the bids received on the two previous openings having failed for various reasons to meet the requirements. The work to be done was the dredging of a channel 4 feet deep and 20 feet wide in the canal and bays along the line of the waterway situated between Synepuxent Bay and Rehoboth Bay, and to excavate so much of a cut 20 feet wide at the bottom to a depth of 6 feet below the adopted mean low-water level as could be made with the available funds from the 6-foot depth in Rehoboth Bay across Rehoboth Neck toward the headwaters of Lewes Creek.

Proposals were opened on July 18, 1893. The lowest bid received for dredging in the lower bays, at 29¾ cents per cubic yard, was rejected as being too high. The lowest bid for excavation at Rehoboth, at 20.4 cents per cubic yard, was tendered by a contractor who, at the first letting in March, 1893, had failed to execute the contract awarded to him, and this bid was therefore rejected, and with the authority of the Chief of Engineers contract was made on July 31, 1893, with the next lowest bidder, Patricius McManus, of Philadelphia, Pa., at the rate of 21 cents per cubic yard, measured in place, the work to be completed by August 1, 1894.

Work was commenced under this contract on August 5, 1893, with a large force of men. The plant consisted of 2 steam shovels, 1½-yard capacity of buckets, 6 locomotive engines, 60 dump cars, and 14 carts. No difficulty was encountered until the level of the water in Rehoboth Bay was reached. To keep the excavation free from water two 10-inch centrifugal pumps were put at work. This enabled the steam shovels to carry the excavation to grade, as the pumps kept the cut free of water. The steam shovels continued the work from station 337 toward the railroad crossing, and although encountering several strong springs were able to make the excavation to grade as far as station 314. At that point a vein of sand carrying a strong stream of water was encountered. Owing to water loosening up the sand, forming a quicksand, the shovels could not be kept from sinking. and further work with them had to be stopped.

From the point where the shovels suspended work to the railroad crossing, a distance of 1,000 feet, there remains to be removed to bring the cutting to grade about 6,000 cubic yards of material, which will be removed by dredging.

On the 1st of November a dipper dredge was put to work at Rehoboth Bay to continue the work through the marsh to the point where the steam shovels began. This dredge has not proved a success and another dredge is to be substituted, and it is expected will be on the ground shortly.

The material encountered in the work has been generally sand, some little sandy clay and some slushy mud in the marsh.

There has been removed under contract to date: By steam shovel, 199,706 cubic yards, and by dredging, 33,117 cubic yards, making a total of 232,823 cubic yards. Two thousand three hundred feet of the cut have been completed.

The material generally has been deposited by cars on the marsh east of the canal, partly on the ground owned by the United States, and the balance on lands of private owners, under agreement with them by the contractor.

Permanent boundary marks defining the limits of the United States ground along the waterway have been put up. They consist of steel railroad rails 8 feet long, driven 6 feet into the ground, and marked with the letters U. S. and numbered, the marks being punched into the rails.

On January 25, 1894, a supplementary contract was entered into with Mr. McManus for additional work of the same character and at the same price and place as that agreed upon in the main contract, the Chief of Engineers having authorized the expenditure for that purpose of the allotment which had previously been assigned for dredging in the lower bays, this work to be completed in four months after completion of the work on the main contract.

The adopted project for improvement is based upon a survey made in 1884. The original report recommended a channel 70 feet wide at the bottom and 6 feet deep, connecting the inland bays between Chincoteague Bay and Delaware Bay, the northern outlet to be at or near Lewes, Del., in the vicinity of the Delaware Breakwater Harbor. The length of the proposed waterway is about 75 miles, and the cost was estimated at $350,000. The project was modified in 1892, the width of the proposed channel for the section lying between Rehoboth Bay and Delaware Bay having been reduced to 20 feet at the bottom, the depth to remain as originally proposed, 6 feet.

At the close of the fiscal year ending June 30, 1893, $69,182 had been expended and a cut had been made about 4 miles long, 20 feet wide and 4 feet deep across the neck of land situated between Little Assawaman Bay and Whites Creek, the latter a tributary of Indian River Bay. Three temporary wooden drawbridges had also been constructed over this cut. This cut has considerably shoaled since it was made. In April last I had an examination made of it and found that at a point just below the bridge at Ocean View there was only 1 foot of water in the canal. At other points and for various distances it has shoaled to from 1½ to 3 feet. The depth originally made seems to be best maintained toward the southern outlet of the canal, where it still is nearly 4 feet. Besides these obstructions a number of stumps of trees have fallen into the canal by the caving in of the banks, and some logs and other débris have been thrown in by unknown persons. These obstructions will be removed when funds become available.

The amount asked for, if appropriated, will be expended in continuing the improvements between Chincoteague Inlet and Delaware Bay.

AMOUNTS APPROPRIATED.

By act approved August 5, 1886	$18,750
By act of August 11, 1888	50,000
By act approved September 19, 1890	50,000
By act approved July 13, 1892	25,000

Money statement.

July 1, 1893, balance unexpended		$74, 568. 00
June 30, 1894, amount expended during fiscal year		49, 198. 44
July 1, 1894, balance unexpended		25, 369. 56
July 1, 1894, outstanding liabilities	$350. 00	
July 1, 1894, amount covered by uncompleted contracts	18, 500. 00	
		18, 850. 00
July 1, 1894, balance available		6, 519. 56
Amount (estimated) required for completion of existing project		206, 250. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896		100, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging and excavating for an inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, Delaware, received and opened July 18, 1893, by William F. Smith, major of Engineers, U. S. A. (retired).

No.	Name and address of bidder.	Time.		Price per cubic yard.	
		Commence.	Complete.	Section I.	Section II.
		1893.	1894.	*Cents.*	*Cents.*
1	J. T. Brown, New York City	Aug. 18	Aug. 18	29¾	29¾
2	P. McManus, Philadelphia, Pa	Aug. 1	Aug. 1		*21
3	B. G. Bailey, Philadelphia, Pa	Sept. 1	Sept. 1		20.4
4	Sanford & Brooks, Baltimore, Md	Sept. 1	Sept. 1	30	30

* Accepted.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

There has been no change, so far as can be learned, in the commerce and navigation heretofore reported, which was as follows: Total receipts and shipments, 1,493 tons; value, $17,387; number of vessels, 10; aggregate tonnage, 64.

H 9.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MARYLAND.

There were no operations during the fiscal year ending June 30, 1894, and the appropriations of $4,000 each made by river and harbor acts of September 19, 1890, and July 13, 1892, are still unexpended, the amount available being limited to expenditure above the Philadelphia, Wilmington and Baltimore Railroad bridge and regarded insufficient to bring about results permanent enough to justify its expenditure. A report upon a survey of this river above Havre de Grace was submitted December 26, 1891, with estimates for a new project.

The project for improvement above and below Havre de Grace includes the making of a 15-foot low-water channel below the town and the removal of the shoal on the west side of the channel opposite Watson Island, above Havre de Grace, to a depth of 8 feet below mean low water. The channel below the town was dredged to a depth of 12 feet in 1885. The survey of December, 1891, showed that it had partially shoaled again. The removal of the eastern bank of the shoal opposite Watson Island has been in progress since 1883, and is done to prevent in a measure the formation of ice gorges at or near the town of Port

Deposit, situated 2¼ miles above the island. About $32,000 have been expended in dredging this shoal, resulting in some temporary relief, but the survey above referred to shows that the area dredged had resumed nearly its original state since the work was suspended in 1889.

Up to the close of the fiscal year ending June 30, 1893, $158,851.63 had been expended for work on this section of the river, including $49,729.15 expended for dredging the channel to the Fishing Battery Light-house, for breakwaters and piers, and for other work for the Fish Commission.

Susquehanna River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNTS APPROPRIATED.

By act approved—	
August 30, 1852	$10,000
June 23, 1866	26,400
July 25, 1868 (allotment)	5,000
April 10, 1869 (allotment)	990
July 11, 1870	12,000
June 14, 1880	28,000
March 3, 1881	15,000
By act passed August 2, 1882	25,000
By act approved—	
July 5, 1884	20,000
August 5, 1886	6,000
By act of August 11, 1888	10,000
By act approved—	
September 19, 1890	4,000
July 13, 1892	4,000
1879, allotment from general appropriation for examination and surveys	500

Money statement.

July 1, 1893, balance unexpended	$8,038.37
July 1, 1894, balance unexpended	8,038.37
Amount (estimated) required for annual dredging	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Fire clay, coal, railroad ties, etc	35,175	$184,325
Building materials, canned goods, lumber, etc	518,000	1,668,480
Fruit, corn, etc	2,500	44,000
General merchandise	....	....
Total	555,675	1,896,805
Shipments:		
Stone, sand, ice, fish, etc	184,725	787,562
Canned goods, lumber, paper, etc	17,310	237,250
Corn, wheat, hay, etc	1,932	105,750
General merchandise	....	....
Total	203,967	1,130,562
Total receipts and shipments	759,642	3,027,367

The above statistics were furnished by the McClenahan & Bro. Granite Company, Port Deposit, Md., and include the commerce at Havre de Grace, Perryville, Port Deposit, Frenchtown, Lapidum, and Conowingo.

H 10.

IMPROVEMENT OF ELK RIVER, MARYLAND.

This river is a tributary of Chesapeake Bay and is navigable for 17 miles as far as the town of Elkton, in Cecil County, where the average rise of tide is 2½ feet. Before improvements were begun in 1873 the least depth in the channel was 1¼ feet.

In 1884 a project, giving a channel 80 feet wide over the bar at Cedar Point, 3 miles below Elkton, and 70 feet wide from Cedar Point to the county bridge in the town, with a general depth of 7 feet at mean low water, was completed at an expense of $31,500. The channel near the bridge soon filled in again, reducing the depth to about 5 feet at low water.

The project for improvement, adopted in 1890, provides for an 8-foot low-water channel 100 feet wide from the lower county bridge at Elkton to the club house opposite Cedar Point, a distance of about 2 miles, at an estimated cost of $24,000. At the close of the fiscal year ending June 30, 1893, $11,504.06 had been expended, exclusive of outstanding liabilities, and the channel completed as projected.

Money statement.

July 1, 1893, balance unexpended	$3,495.94
June 30, 1894, amount expended during fiscal year	3,492.57
July 1, 1894, balance available	3.37

H 11.

IMPROVEMENT OF FAIRLEE CREEK, MARYLAND.

There were no operations during the fiscal year ending June 30, 1894, no appropriation having been made by Congress in the river and harbor bill approved July 13, 1892.

The original depth at the mouth before improvements were begun was 2 feet at low tide. Within the creek it was about 5 feet. Navigation was, and still is, carried on by a few flat-bottomed so-called lime boats and by one small schooner.

The project adopted in 1888 embraces the dredging of a channel 100 feet wide and 7 feet deep at mean low water across the bar at the mouth and up the creek for a distance of about 2⅗ miles; also the dredging of a turning basin at the upper end of the proposed channel if a certain wharf should be built there before the channel is completed. The total estimated cost of the improvement is $15,558.

Up to the close of the fiscal year ending June 30, 1893, $10,000 had been expended and the channel, as proposed, from deep water in the bay to the mouth had been completed and a portion of the channel inside the creek had been dredged to the required depth for a distance of 4,738 feet and for a width of 50 feet.

The wharf referred to has not yet been built, and no appreciable increase in the commerce of the creek, which has always been very limited, has been noted since improvements were begun.

The amount asked for, if appropriated, will be expended in completing the channel inside the creek.

Fairlee Creek is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNTS APPROPRIATED.

By acts of—

August 11, 1888	$5,000
September 19, 1890	5,000

Money statement.

Amount (estimated) required for completion of existing project	$5,558.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	5,558.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

CHESTERTOWN, MD., *April 19, 1894.*

DEAR SIR: In reply to yours of 18th instant, I am sorry to say that the wharf has not been built, nor is there any probability of its being built. At the time the improvement of the navigation of Fairlee Creek was first agitated there was every likelihood of a large increase of the business of the creek through peaches, etc. The failure of the peach orchards, together with the prostration in the agricultural interests of the county, have put a complete damper upon all kinds of enterprise In yours of the 9th instant you ask me to fill up the blanks furnished for the imports and exports of the creek. I do not think it would pay for the trouble of collecting the statistics and would suggest that you fill them from the last report, as I do not think there would be any material difference, if accurately ascertained. I regret very much that the work must stop, as I can assure you that the work done has been of great service to the navigation of the creek.

Yours, truly,

W. S. WALKER.

Gen. W. F. SMITH.

The last statistics relating to Fairlee Creek are published in the Annual Report for 1892, and give total receipts and shipments 11,479 tons and a valuation of $242,305.

H 12.

IMPROVEMENT OF CHESTER RIVER, MARYLAND, FROM CRUMPTON TO JONES LANDING.

There were no operations on this river during the fiscal year 1894, for want of funds.

The river had been under improvement previous to 1890, when the present project was adopted. At that time there were many shoals in the river between Crumpton and Jones Landing, with 3 or 4 feet of water over them.

The adopted project for improvement is based upon a survey made in 1889, and is for a 6-foot low-water channel 60 feet wide from the drawbridge at Crumpton to a point about 1 mile below Millington, supposed to be at Jones Landing, a distance of 6¼ miles. The estimated cost is $12,750. At the close of the fiscal year ending June 30, 1893, $7,958 had been expended and the channel had been improved at various points, in accordance with the project, from Crumpton to Kirbys Landing, a distance of about 4 miles. About 1½ miles of the channel remain to be improved.

The dredged channel is in good condition; it does not as yet extend far enough, however, to have any marked influence upon the commerce of the river.

Amount asked for, if appropriated, will be expended in completing the approved project.

This work is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNTS APPROPRIATED.

By acts approved—	
September 19, 1890	$5,000
July 13, 1892	3,000

Money statement.

July 1, 1893, balance unexpended	$42.00
June 30, 1894, amount expended during fiscal year	33.67
July 1, 1894, balance unexpended	8.33
Amount (estimated) required for completion of existing project	4,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	4,750.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons	Value.
Receipts:		
Fertilizers	2,219	$56,545
General merchandise	13,965	558,600
Total	16,184	615,145
Shipments:		
Oysters	1,457	31,570
Fruit	8,689	130,338
Corn, wheat, oats, etc	3,038	115,629
General merchandise	2,758	110,320
Total	15,942	387,857
Total receipts and shipments	32,126	1,003,002

Vessels trading in Chester River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft	Trips.
			Feet.	
Steamer	1	553	5	Daily, except Sunday, eleven months of the year.
Do	1	418	6	Do.
Do	1	368	7½	Daily, except Sunday, eight months of the year.
Do	1	215	7	Daily, except Sunday, nine months of the year.

The above statistics were furnished by Mr. George Warfield, president of the Chester River Steamboat Company, and accompanied by the following letter:

LETTER OF MR. GEORGE WARFIELD.

BALTIMORE, *April 21, 1894.*

SIR: I am in receipt of your favor of the 20th, relative to the statistics furnished by this company of its business for 1893.

The information furnished in 1893 for the year 1892 was concerning the business of this company from and to that part of Chester River above Chestertown, or the Crumpton section alone.

The information furnished a day or two ago embraces our entire freighting business to and from Chester River.

Respectfully,

GEORGE WARFIELD, *President.*

Gen. WILLIAM F. SMITH,
U. S. Agent.

H 13.

IMPROVEMENT OF CHOPTANK RIVER, MARYLAND.

Nothing was done on this improvement during the past fiscal year, for want of funds.

At the time of the adoption of the present project the river between Greensboro and Denton varied in depth from 2 to 8 feet at low water, and navigation extended only 3 miles above Denton; on the remaining 5 miles of the river freight had to be transported by lighters.

The object of this improvement, which has been carried on since 1881, is to make an 8-foot low-water navigation between the towns of Denton and Greensboro, a distance of 8 miles, the width of the channel to be 75 feet. The estimated cost of the improvement is $79,000. Up to the close of the fiscal year ending June 30, 1893, $48,000 had been expended in making a channel not less than 75 feet wide and 7½ feet deep between Greensboro and the Brick Mills, a distance of about 4 miles. The remaining 4 miles, to Denton, have partly been improved by dredging the channel, where needed, to a depth of 5 and 6 feet and widening it to about 40 feet. This section and several points in the upper river remain, therefore, to be dredged to the proposed width and depth, 75 feet and 8 feet, respectively. Shortly after the main obstructions had been removed, in 1887, steamboat navigation with Baltimore was established, and since that time commerce has steadily increased.

No funds on hand or expended during the year.

It is proposed to expend the amount asked for, if appropriated, in dredging the existing channel to the full depth and width, in accordance with the original project.

This work is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	5,000
By act passed August 2, 1882	5,000
By act approved—	
July 5, 1884	5,000
August 5, 1886	10,000
By act of August 11, 1888	7,500
By act approved—	
September 19, 1890	7,500
July 13, 1892	3,000

Money statement.

Amount (estimated) required for completion of existing project	$20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Rock phosphate, coal, etc	600	$4,750
Fertilizers, shingles, lumber, etc	1,000	16,800
Hay, etc	500	5,000
General merchandise	500	20,000
Total	2,600	46,550
Shipments:		
Canned goods, baskets, etc	776	25,500
Wheat	1,590	39,750
General merchandise	200	8,000
Total	2,566	73,250
Total receipts and shipments	5,166	119,800

Vessels trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	175	6	Weekly.

The above statistics were furnished by Capt. D. S. Brockway, Greensboro, Md.

H 14.

IMPROVEMENT OF LA TRAPPE RIVER, MARYLAND.

There were no operations during the fiscal year ending June 30, 1894, for want of funds.

The channel within the river proper is fairly straight and has an average depth of 8 feet at mean low water; the channel at the mouth, however, is seriously obstructed by two interlocking bars, which make navigation in stormy days and during low tides very difficult. The average rise of the tide is 1.55 feet.

During the years 1884 and 1889 the citizens of the adjoining country interested in the commerce of the river expended a total of $5,333.50 in the improvement of the mouth and at Trappe Landing, which is situated at the head of the river.

A survey of this river was made in accordance with the requirements of the river and harbor act of September 19, 1890, and the report, with estimates for its improvement, is printed in the Annual Report of the Chief for Engineers for 1891, pp. 1215–1218. The plan of improvement therein proposed is for a channel 150 feet wide and 11 feet deep at mean low water across the bar at the mouth, and to dredge the existing channel inside the river where needed to a width of 75 feet and to a depth of 8 feet at mean low water from the mouth to Trappe Landing, with a turning basin at the latter point. The estimated cost of the improvement is $7,250.

The project was adopted in 1892, an appropriation of $2,500 having been made by Congress for beginning work, and dredging was done in April, 1893, 20,000 cubic yards of material, consisting of sand, mud, and marl, being removed. The result was a channel across the bar at the mouth, 100 feet wide and 11 feet deep at mean low water, much straighter than the old channel, which was very tortuous.

The amount expended on this improvement to the end of the fiscal year 1893 was $2,496.30.

It is proposed to expend the amount asked for, if appropriated, in completing the project.

La Trappe River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNT APPROPRIATED.

By act approved July 13, 1892	$2, 500. 00

Money statement.

July 1, 1893, balance unexpended	$3. 70
July 1, 1894, balance unexpended	3. 70
Amount (estimated) required for completion of existing project	4, 750. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	4, 750. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of civil sundry act of March 3, 1893.	

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Cord wood, coal, hides, railroad ties, and ice	2, 370	$14, 050
Bricks, fertilizers, flour, furniture, etc	3, 550	45, 400
Butter, cattle, eggs, grain, hay, etc	4, 627	118, 400
General merchandise	6, 000	240, 000
Total	16, 547	417, 850
Shipments:		
Coal, cord wood, and building sand	1, 585	6, 100
Bricks, carriages, fertilizers, lumber, etc	2. 812	89, 000
Butter, cattle, eggs, poultry, grain, etc	1, 410	99, 650
General merchandise	6, 000	240, 000
Total	11, 807	434, 750
Total receipts and shipments	28, 354	852, 600

Vessels trading in La Trappe River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	600	10	Daily.
Schooners	4	350	7	Weekly.
Sloops	100	1,500	5	Oyster boats.

A large canning house is to be built here this year.

The above statistics were furnished by Capt. C. C. Wheeler, Wheeler's Line steamers, Baltimore, Md.

H 15.

IMPROVEMENT OF WARWICK RIVER, MARYLAND.

No work was done on this improvement during the past fiscal year, for want of funds.

A survey of the river was made in accordance with the requirements of the river and harbor act of September 19, 1890, and the report, with estimates for its improvement, is printed in the Annual Report of the Chief of Engineers for 1891, pp. 1218–1221. The plan of improvement therein proposed is the dredging of a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in the Choptank River to the wharves at Secretary Landing, including a turning basin at the latter point, at an estimated cost of $18,600.

The project was adopted in 1892, an appropriation of $6,000 having been made by Congress for beginning work. Operations were begun in December, and by the following March 4,400 feet of the approved channel had been completed, the width at one sharp turn increased to 150 feet, and a portion of the turning basin at the steamboat wharves dredged to a depth of 10 feet to give more room for the large steamers landing there.

The amount expended on the improvement to the close of the fiscal year 1893, was $5,991.23.

The work done has removed some of the most serious obstacles to the entrance of steamers into the river during low tides and high winds, and vessels now navigate the river with less difficulty.

It is proposed to expend the amount asked for, if appropriated, in dredging the remaining length of the approved channel.

Warwick River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1891, is $3,038,688.22.

AMOUNT APPROPRIATED.

By act approved July 13, 1892	$6,000

Money statement.

July 1, 1893, balance unexpended	$8.77
July 1, 1894, balance unexpended	8.77
Amount (estimated) required for completion of existing project	12,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	6,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, phosphate rock, ice, etc	6,350	$116,300
Fertilizer, flour, shingles, etc	1,696	22,000
General merchandise	20,000	75,000
Total	28,046	213,300
Shipments:		
Cord wood, etc	1,800	3,000
Canned goods, etc	10,500	600,000
Fruit, wheat, farm products, etc	10,462	424,000
Total	22,762	1,027,000
Total receipts and shipments	50,808	1,240,300

Vessels trading in Warwick River, Maryland.

Two steamers, 8 and 8½ feet draft, make daily trips. About 100 sloops, schooners, and bugeyes are in constant service.

The above statistics were furnished by the Choptank Steamboat Company, Baltimore, Md.

H 16.

IMPROVEMENT OF HARBOR AT CAMBRIDGE, MARYLAND.

At the beginning of the fiscal year work under a contract with the American Dredging Company, of Philadelphia, Pa., was in progress. Dredging had been begun on May 24 preceding, and at the end of the fiscal year June 30, 1893, 42,744 cubic yards of material had been removed. The contract was completed on July 24, 1893, 11,862 cubic yards having been removed during that month, making a total of 54,606 cubic yards removed under the contract. The work accomplished during the fiscal year was the deepening of an additional irregular area of 86,500 square feet in the inner harbor to 10 feet below mean low water and the widening of the main channel at the bend which the latter makes at the entrance to the harbor. The dredging at the bend was carried to a depth of 12 feet below mean low water. About one-fifth of the material removed by the dredge during last season's operations consisted of soft mud and the remainder was hard fire clay and compact fine sand in about equal proportions; all being scowed away and deposited in deep water in the Choptank River about 1 mile from the harbor. The channel above the bridge remains to be dredged to complete the present project.

The river and harbor act of July 13, 1892, appropriated $7,737 for completing this improvement, with the proviso that no part thereof shall be expended above the bridge until the draw in it shall have been widened sufficiently to accommodate the commerce of the river. The widening of the draw of the bridge had been determined upon by the Department when the question of the expenditure of $5,000 appropriated September 19, 1890, was under consideration. This appropriation, together with the one of July 13, 1892, was held in reserve to await the widening of the draw, and as the draw had not been widened when the work to be done on the improvement was in contemplation in

1893, it was recommended to the Department in a project submitted March 1, 1893, that so much of the available funds as should be needed be expended in dredging the harbor below the bridge only, in accordance with the general project, and this was approved.

The project for improvement is based upon a survey made in 1887, and provides for a channel 150 feet wide and 12 feet deep at mean low water between the 12-foot depth in the Choptank River and the railroad wharf; for the dredging of an irregular area in the harbor below the drawbridge to a depth of 10 feet, and for a channel 500 feet long, 150 feet wide, and 8 feet deep above the bridge, the estimated cost being $17,736.60. Up to the close of the fiscal year ending June 30, 1893, $6,028.89 had been expended, and the 12-foot channel from the Choptank River to the railroad wharf and about one-fourth of the area to be deepened in the inner harbor had been completed.

This harbor was originally improved by the citizens of Cambridge who, up to the year 1871, had expended $7,500 for that purpose. In 1871 the General Government began improvements under a project made by Col. William P. Craighill, Corps of Engineers, which was completed in 1879, resulting in a channel not less than 100 feet wide across the bar at the entrance and the deepening of the inner harbor, the dredging in both cases being carried to a depth of 8 feet below mean low water. The channel across the bar was increased in width in 1884 with an appropriation of $2,500, made in 1879. The total amount expended on this project was $32,500.

The improvement of the harbor has had a marked influence upon the growth of the town of Cambridge, which has more than doubled since 1870. The harbor itself is small, and on many days during the oyster season wholly inadequate to shelter the large number of vessels of all kinds which trade or are owned there.

The channel across the bar has a tendency to fill up from the littoral drift coming down the south shore of the Choptank River, and in consequence has been dredged three times. Its condition since operations ceased about a year ago is supposed to be fair, as no complaints have been made; but it will undoubtedly need redredging in the near future, or some protective works on the east side to prevent its shoaling.

The funds now available, and which are withheld until the county authorities widen the draw of the bridge across the upper harbor, will be sufficient to complete the present project.

Cambridge Harbor is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1894, is $3,038,688.22.

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1871	$10,000
June 10, 1872	10,000
March 3, 1873	5,000
June 18, 1878	5,000
March 3, 1879	2,500
By act of August 11, 1888	5,000
By act approved—	
September 19, 1890	5,000
July 13, 1892	7,737

Money statement.

July 1, 1893, balance unexpended	$11,708.11
June 30, 1894, amount expended during fiscal year	4,846.17
July 1, 1894, balance unexpended	6,861.94

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, phosphate rock, oysters, etc	122, 435	$2, 198, 210
Fertilizers, flour, lumber, etc	17, 897	136. 400
Cattle, horses, grain, etc	11, 664	251, 230
General merchandise	27, 000	1, 080, 100
Total	178, 996	3, 665, 940
Shipments:		
Ship timber, etc	58, 000	400, 000
Canned goods, fertilizers, etc	61, 062	542, 300
Fruit, poultry, etc	14, 205	316. 165
General merchandise	2, 000	280, 000
Total	135, 267	1, 338, 465
Total receipts and shipments	314, 263	5, 004, 405

Vessels trading in Cambridge Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	4	2, 219	7 to 9	Two daily and two triweekly.

Fully 700 sailing vessels of all classes trade in the harbor during the year. One large three-mast schooner and three small schooners were built during the year.

The above statistics were furnished by the Maryland and Choptank Steamboat companies. The receipts and shipments are of those companies only. The remainder was asked for from prominent citizens, but was not furnished.

H 17.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

There were no operations during the past fiscal year, for want of funds.

This river is in the western portion of Sussex County, Del., and is a tributary of the East Fork of the Nanticoke River. It is a tidal stream and navigable for about 7 miles. At the head of navigation is situated the town of Laurel, with extensive manufacturing and commercial industries.

The General Government expended $35,000 between the years 1881 and 1889 in improving about 2 miles of the river at and immediately below Laurel. A channel 50 feet wide and 6 feet deep at mean low water was dredged, and the commerce of the river increased more than 100 per cent in eight years.

In accordance with the requirements of the river and harbor act of September 19, 1890, a preliminary examination was made of this river with the view of enlarging the channel previously dredged. The report, with estimates, is printed in the Annual Report of the Chief of Engineers for 1891, pp. 1209-1211. The plan of improvement therein recommended is to dredge the existing channel to a depth of 8 feet at mean low water and to a width of 70 feet, beginning above the Bethel bridge, about 3 miles below Laurel, at an estimated cost of $15,000.

The project was adopted in 1892, an appropriation of $5,000 having been made by Congress July 13. Operations were commenced in December, 1892, and by the following April 43,997 cubic yards of material had been removed. A channel of the approved dimensions, 70 feet wide and 8 feet deep at mean low water, was dredged for a distance of 6,455 feet, beginning at a point 1,000 feet above the bridge at Bethel and ending 680 feet above Hitch's upper wharf, and an additional cut, also 8 feet deep, but only 40 feet wide, was dredged for a length of 215 feet across a shoal situated just beyond the section of the channel that had been dredged to the full width.

The amount expended on the improvement to the close of the fiscal year 1893 was $4,900.45, exclusive of the $35,000 expended before the adoption of the present project.

The amount asked for, if appropriated, will be expended in continuing the improvements toward Laurel in accordance with the project.

Broad Creek is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the fiscal year ending June 30, 1894, is $12,686.

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	10,000
By act passed August 2, 1882	5,000
By act approved August 5, 1886	10,000
By act of August 11, 1888	5,000
By act approved July 13, 1892	5,000

Money statement.

July 1, 1893, balance unexpended	$99.55
June 30, 1894, amount expended during fiscal year	88.60
July 1, 1894, balance unexpended	10.95
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893	

COMMERCIAL STATISTICS.

Commercial statistics were asked for, but have not been received, except as to vessels trading in the river, which are as follows: One steamer, 5 feet draft, making daily trips to Laurel and Bethel, Del., and 8 schooners, 7 feet draft and an aggregate tonnage of 630, engaged in the lumber trade.

One schooner, about 8 feet draft and a tonnage of 360, was built during the year.

The above information was furnished by Wooten & Fooks, of Laurel, Del.

H 18.

IMPROVEMENT OF WICOMICO RIVER, MARYLAND.

At the beginning of the fiscal year a contract dated October 26, 1892, was in force with Chester T. Caler, of Norfolk, Va., for dredging at the rate of 9.9 cents per cubic yard, measured in scows, to be completed on or before May 30, 1894.

Operations were begun on November 1, 1893, and were completed on January 27, 1894. The total amount of material, being sand, mud, and some clay, removed under the contract was 55,000 cubic yards, all of which was carried away in scows and dumped in coves or deep places of the river about 6 miles below Salisbury. The season's work consisted in widening so much of the channel dredged in 1891 to the full approved width as the available funds would permit. In that year a cut 30 feet wide and 9 feet deep at mean low water had been made from near Goose Island Wharf to the drawbridge at Salisbury, the lower and upper termini, respectively, of that portion of the river which is to be improved. This cut having been dredged along the northern edge of the proposed channel, the additional width wanted was principally made south of it, requiring the dredging of an area from 1 to 110 feet wide, extending from opposite the dock of the Maryland Steamboat Company to Island Point, a total distance of about 4,000 feet. Within the lower section a portion of the channel was made proportionally wider north of the old 30-foot cut, in order to round off a sharp point on that side situated just below the lower end of the old dikes. The area dredged on this side formed a continuous strip 1,200 feet long and varied in width from 1 to 70 feet. The minimum depth obtained in each case was 9 feet at mean low water.

The present project for improvement is based upon a survey made in 1889 and is for a channel 9 feet deep at mean low water, beginning at the 9-foot depth in the river near Goose Island Wharf and ending at the drawbridge in the town of Salisbury, the width to be from 100 to 150 feet. The estimated cost is $23,200. The project was adopted in 1890, an appropriation of $10,000 being made by Congress to begin improvements, and a further appropriation of $6,500 was made in 1892. In the latter year 30 feet of the proposed width of the channel was dredged to the approved depth of 9 feet throughout the section of the river covered by the project. At the close of the fiscal year ending June 30, 1893, $10,394.99 had been expended on this improvement.

The portion of the river at and just below Salisbury has been under improvement by the United States since 1872. At that time the navigable channel, with a least depth of 8 feet at low water, extended to within 2 miles below Salisbury. The extreme upper portion, as far as the milldam in the heart of the town, was quite shoal and had an average depth of only 18 inches at low tide. Between the years 1872 and 1885 a channel was dredged from 75 feet to nearly 100 feet wide and 7 feet deep at low water from deep water below to the drawbridge in the town, at a total cost to the Government of about $49,000, certain portions of the channel being protected on each side by dikes constructed of piles and sheet piling. The expense of building these dikes was partly defrayed by the citizens of Salisbury, who also subsequently expended about $25,000 in dredging a large section of the river above the drawbridge to a depth of 7 feet. It is well known what an important influence these improvements had after they were begun upon the remarkable growth of the town and the commerce of the river.

The improvements now being made under the present project are completed for about one-half the length of the proposed channel, that is, from the drawbridge down to Island Point, a distance of 4,800 feet. Only immediately below the drawbridge a slight shoaling has taken place, some sand having washed over the abrupt edge of the dredged channel from the shoaler river above. Farther down the dredged channel should be, in accordance with previous experience, quite permanent and in good condition.

It is proposed to complete the project if the amount asked for is appropriated.

Wicomico River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there no revenue was collected during the fiscal year.

AMOUNTS APPROPRIATED.

By act of—		By act of—	
June 10, 1872	$5,000	March 3, 1879	$3,000
March 3, 1873	5,000	June 14, 1880	5,000
June 28, 1874	5,000	March 3, 1881	2,000
March 3, 1875	5,000	July 5, 1884	10,000
August 14, 1876	5,000	September 19, 1890	10,000
June 18, 1878	5,000	July 13, 1892	6,500

Money statement.

July 1, 1893, balance unexpended	$7,062.07
June 30, 1894, amount expended during fiscal year	6,710.74
July 1, 1894, balance unexpended	351.33
Amount (estimated) required for completion of existing project	6,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	6,700.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Oysters, fish, etc	3,201	$37,500
Bricks, provisions, flour, etc	36,448	439,564
Horses, cattle, grain, etc	536	60,320
General merchandise	10,000	400,000
Total	50,185	937,384
Shipments:		
Cord wood, etc	5,087	11,200
Canned goods, fertilizers, machinery, etc	10,657	155,150
Vegetables, fruit, poultry, etc	1,285	52,930
General merchandise	25,000	1,000,000
Total	42,029	1,219,280
Total receipts and shipments	92,214	2,156,664

Vessels trading in Wicomico River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	572	6	Triweekly.
Do	1	175	6½	Weekly.
Do	1	10	2	Daily.
Schooners	11	697	6½ to 10	Weekly.

The above statistics were furnished by the Maryland Steamboat Company and the Hon. E. Stanley Toadvin, of Salisbury, Md. The latter adds as follows: Many sloops and other vessels come here to trade and the harbor is never without boats of this class in it. There are other vessels sailing out of the river that come to Salisbury occasionally only.

H 19.

IMPROVEMENT OF MANOKIN RIVER, MARYLAND.

No work was done on this improvement during the past fiscal year for want of funds.

Before improvements were commenced in 1891 the depth of water at the mouth of the river, at the so-called "Mud Flats," was between 1 and 2 feet at low tide. These flats are about 2½ miles wide and made navigation, except at high water, impossible, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of the tide at the flats is 2.6 feet.

The adopted project for improvement is for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharp Point, embracing the section called the "Mud Flats," at an estimated cost of $30,000.

Up to the close of the fiscal year ending June 30, 1893, $14,360.05 had been expended and the proposed cut across the "Mud Flats" had been made for a width of 60 feet and a depth of 6 feet at low tide, which opened the river for navigation during low tide. Several abrupt points in the upper river above Sharp Point were also removed and navigation upon the whole river at low tide was thereby greatly improved.

It is proposed to expend the amount asked for, if appropriated, in widening the channel across the "Mud Flats," in accordance with the project.

Manokin River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there no revenue was collected during the fiscal year.

AMOUNTS APPROPRIATED.

By acts approved—	
September 19, 1890	$7,500
July 13, 1892	7,500

Money statement.

July 1, 1893, balance unexpended	$639.95
June 30, 1894, amount expended during fiscal year	175.00
July 1, 1894, balance unexpended	464.95
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, cord wood, timber, lumber, ice	6,480	$39,484
Bricks, canned goods, fertilizers, etc	5,313	182,154
Grain, horses, hay, potatoes	1,454	36,937
General merchandise	120,800	452,000
Total	134,047	2,710,575
Shipments:		
Logs, railroad ties, ship timber, etc	11,936	95,227
Canned goods, flour, mill work	2,339	68,392
Fruit, vegetables, grain, hay, etc	6,231	192,954
General merchandise	24,875	984,200
Total	44,881	1,340,773
Total receipts and shipments	178,928	4,051,348

There are about 320 schooners, pungies, sloops, and other vessels engaged in coastwise trade sailing from the river, besides 1 steamer, 4 feet draft, which makes daily trips.

The foregoing statistics were furnished by the president of the Manokin River Steamboat Company, accompanied by the following letter:

PRINCESS ANNE, MD., *May 28, 1894.*

SIR: I beg to hand you herewith statistics, commercial, of Manokin River, which I have prepared as carefully as possible.

Our shipments of fruit and vegetables from the river have largely increased this season over any previous year.

Yours, truly,

HAMPDEN P. DASHIELL.

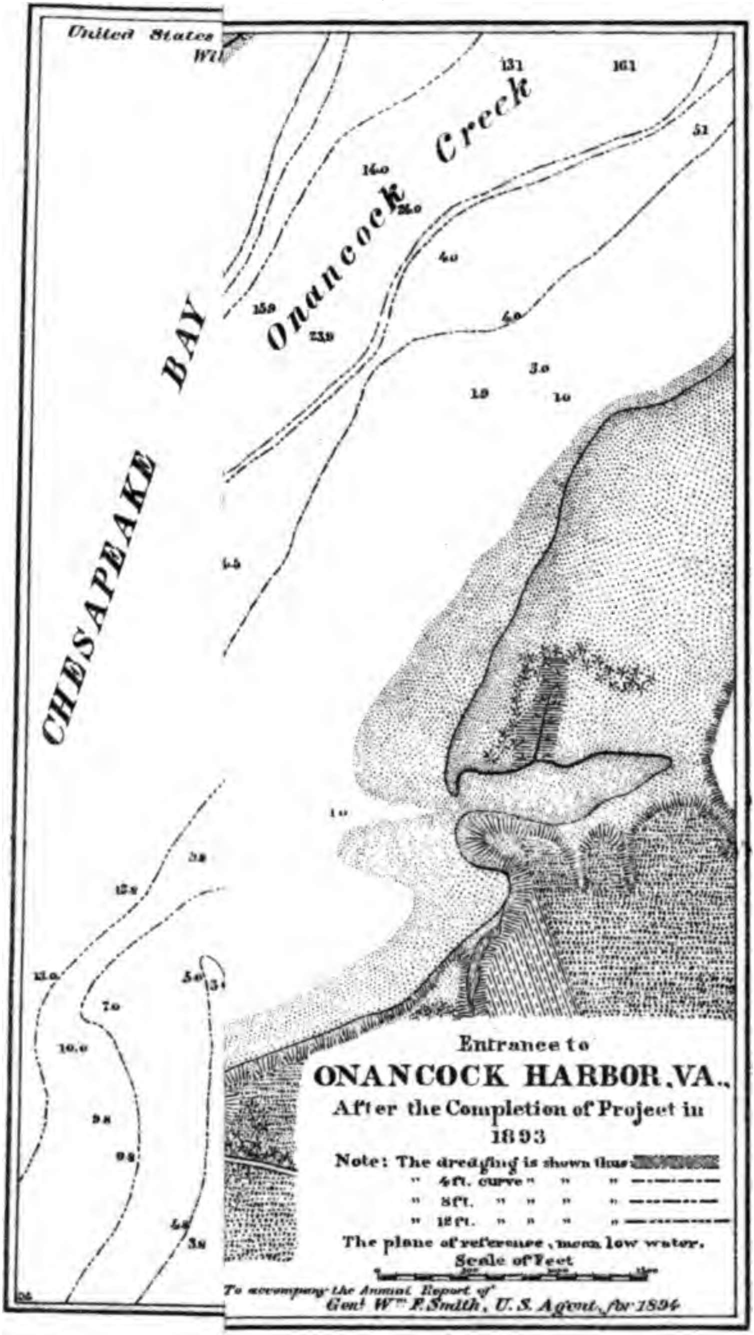
Gen. WILLIAM F. SMITH,
U. S. Agent.

H 20.

IMPROVEMENT OF ONANCOCK HARBOR, VIRGINIA.

At the beginning of the fiscal year a contract dated October 26, 1892, was in force with Chester T. Caler, of Norfolk, Va., for dredging at the bar at the rate of 13 cents per cubic yard, measured in scows, the contract to be completed on or before December 31, 1893.

Work was begun on July 17, 1893, and completed on October 20 following, 41,154 cubic yards of fine, hard sand having been removed under the contract. The unusually stormy season interfered much at this exposed locality with the progress of the work, compelling the contractor frequently to withdraw his machine from the place of operations and to go into the creek for safety. Dredging was done at the outer bar and at the inner bar, also called the "middle ground," and consisted in widening the channels dredged in 1891 at the former place to 300 feet and at the latter to 200 feet, the full dimensions as required by the project. The dredging in both cases was made to a depth of 8 feet below mean low water, and the excavated material was carried away in scows and deposited in deep water in the bay, about 1½ miles from the work. This completes the project.



Entrance to

ONANCOCK HARBOR, VA.,

After the Completion of Project in 1893

Note: The dredging is shown thus ▨
" 4 ft. curve " " " - - - - -
" 8 ft. " " " " - - - - -
" 12 ft. " " " " - - - - -

The plane of reference, mean low water.

Scale of Feet

To accompany the Annual Report of
Gen^l W^m F. Smith, U.S. Agent, for 1894

The Friedenwald Co., Photo-Lith., Balto. Md. Eng. 53 3.

UNIV. OF MICH.

The present project for improvement is based upon a survey made in 1889, and is for a channel 8 feet deep at mean low water, 300 feet wide across the outer bar and 200 feet wide across the inner bar; estimated cost $12,511. The project having been adopted in 1890, these channels were dredged in 1891 for a width of 150 and 100 feet, respectively, under an appropriation of $6,000, made September 19, 1890, and no further work was done thereon until July, 1893. Up to the close of the fiscal year ending June 30, 1893, $5,931.40 had been expended on this project.

The bar at the mouth of Onancock Creek had previously been improved by the General Government under a project made in 1878. In 1879 $3,000 were appropriated and expended in dredging a channel 100 feet wide and 8 feet deep. After a lapse of 10 years the width had been reduced to 50 feet and the depth to 5½ feet by shoaling, caused by fine sand rolling into the cut under the impulse of littoral currents coming down the north shore. An appropriation of $5,000, made in 1880, was expended under the same project in dredging inside the creek. The improvements made there are more permanent. No examination of the channel at the bar has been made since it was completed. As, however, the tendency to shoal still prevails, it is believed that it is gradually filling up again.

As the project has been completed, no further funds are needed.

Onancock Harbor is in the collection district of Cherrystone, Va. Cape Charles City is the nearest port of entry. No revenue was collected during the fiscal year ending June 30, 1894, the business consisting only of licensing vessels, etc.

AMOUNTS APPROPRIATED.

By act approved—

March 3, 1879	$3,000
June 14, 1880	5,000
September 19, 1890	6,000
July 13, 1892	6,511

Money statement.

July 1, 1893, balance unexpended	$6,579.60
June 30, 1894, amount expended during fiscal year	6,579.60

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, bricks, shingles, etc	373,863	$1,547,750
Butter, cattle, grain, etc	386	23,260
General merchandise	7,500	300,000
Total	381,749	1,871,010
Shipments:		
Fertilizers, barrels, fruit, etc	1,250	31,500
Cattle, sheep, vegetables, etc	14,186	98,000
General merchandise	25	1,000
Total	15,461	130,500
Total receipts and shipments	397,210	2,001,510

Vessels trading in Onancock Harbor, Virginia.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	3	1,468	6	Four times a week.
Schooners	9	379	6½ to 8	Weekly.
Bugeyes	4	56	4 to 5½	Do.
Sloops	2	15	3 and 4	Do.

The above statistics were furnished by the Eastern Shore Steamboat Company, Baltimore, Md.

H 21.

IMPROVEMENT OF HARBOR AND APPROACHES AT CAPE CHARLES CITY, VIRGINIA.

There were no operations during the fiscal year ending June 30, 1894. The river and harbor act of July 13, 1892, appropriated $10,000 for continuing improvement, with a proviso, as follows:

> *Provided,* That before any Government money shall be expended in the improvement of this harbor or any of its approaches, the owners of the basin forming the harbor and the channel or canal leading thereto, or connecting said harbor with Cherrystone Inlet, shall execute, or cause to be executed, and file with the Secretary of War an instrument in writing satisfactory to the said Secretary of War, giving to any and all vessels upon any and all occasions for all time to come the right to enter and remain in said harbor and transact business therein without charge, except legitimate, usual, and reasonable wharf charges, to be determined by the Secretary of War in event of disagreement, and shall further legally dedicate, or cause to be dedicated, to public use an approach to the wharves of said harbor from the nearest public highway of not less than 40 feet in width, to be approved by the Secretary of War.

At the end of the fiscal year the owners of the harbor had not filed with the Secretary of War the instrument required by the above-quoted act, as far as I am advised.

The project for improvement, adopted in 1890, is for dredging in the harbor to a depth of 14 feet below mean low water, and the entrance thereto, together with the present channel in Cherrystone Inlet and across Cherrystone Bar to a depth of 16 feet below the same plane of reference; the channel in the inlet to be 100 feet and that across the bar 200 feet in width. The original project submitted with the report on the survey made in 1889 included protective works of stone at the entrance, the total cost of the improvement as then estimated being $142,340, of which $45,400 was for dredging.

Up to June 30, 1893, the sum of $23,110.93 had been expended, and about one-half of the area of the harbor had been dredged to 14 feet below mean low water; a cut 16 feet deep had been made within the entrance, 50 feet wide at the shore end and 480 feet wide at the outer end, or in Cherrystone Inlet channel, and a shoal one mile below the harbor was partly removed to the same depth. The dredged channels are supposed to be in a fair condition, except the one at the entrance, which has partly shoaled again.

It is proposed to continue operations as projected, if the amount asked for is appropriated and the law permits the expenditure of the available funds.

Cape Charles Harbor is in the collection district of Cherrystone, Va. Cape Charles City is the nearest port of entry. No revenue was collected during the fiscal year ending June 30, 1894, the business consisting only of licensing vessels, etc.

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	$25,000
July 18, 1892	10,000

Money statement.

July 1, 1893, balance unexpended	$11, 889. 07
June 30, 1894, amount expended during fiscal year	100. 00
July 1, 1894, balance unexpended	11, 789. 07
Amount (estimated) required for completion of existing project	10, 400. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10, 400. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1893.

Receipts and shipments.

Class.	Tons.
Receipts:	
Grain, flour, fruit, poultry, etc	86, 129
Coal, iron, lumber, ores, etc	211, 046
Machinery, agricultural implements, etc	4, 683
Miscellaneous merchandise	8, 220
Total	310, 078
Shipments:	
Mill products, canned goods, meats, etc	14, 039
Sugar, oil, leather, etc	21, 812
Iron and steel rails, machinery, wagons, etc	38, 715
Miscellaneous merchandise	8, 708
Total	83, 274
Total receipts and shipments	393, 352

Estimated value, $15,150,000.

Vessels entering and trading in harbor of Cape Charles City, Va.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	6	1, 757	6 to 9	Two daily; four triweekly.
Tugboats	4	607	8 and 9	Daily.
Schooners	125	5, 950	3 to 14	In oyster, produce, brick, and general trade.
Sloops	231	1, 900	3 to 5	

The above statistics were furnished by Mr. H. W. Dunne, superintendent New York, Philadelphia, and Norfolk Railroad.

H 22.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of tugboat Charles Lea, Mispillion River, Delaware.—At the beginning of the fiscal year authority had been received to remove this wreck at an estimated cost of $150. The usual notice to owners and advertisement for proposals having been published, four bids received in response thereto were opened on August 18, 1893, and were rejected as being too high, the lowest being $150. Subsequently W. G. Abbott, of Milford, Del., made an informal proposal to remove the wreck for $100, which was accepted. On September 7 the removal was completed, the hull having been broken up and landed above high-water mark. The wheel of the boat appearing to have some value was sold for $3, and the amount returned to the Treasury. The total expenditures on account of removing the wreck were, including advertising, etc., $123.53. The unexpended balance of $26.47 was returned to the Treasury.

Abstract of proposals received by Gen. William F. Smith, U. S. agent, Wilmington, Del., for removing wreck of steam tug Charles Lea.

No.	Name and address of bidder.	Amount.
1	George F. Pierce, Milford, Del	$150
2	Johnston & Townsend, Somers Point, N. J	345
3	Elijah D. Register, Lewes, Del	340
4	Jos. D. Truxton, Lewes, Del	340

These proposals were rejected as excessive.

Obstruction caused by sunken schooner off Kent Island, Chesapeake Bay.—This wreck was reported to me on May 31, 1893, by officers of the Maryland oyster navy. By authority from the Chief of Engineers an examination was made on July 2, 1893, and the obstruction endangering navigation was found to be the mast of a sunken schooner broken off, but still attached to the wreck and projecting considerably above the water. The wreck itself lay in 14 fathoms of water. Authority was received for the removal of that part of the mast which was liable to interfere with navigation. A steamer was employed to pull the mast up, and this was done on July 21, 1893, the total expense being $34.29.

Wreck of the canal boat J. D. Hilton, Christiana River, Delaware.—This wreck was reported to the War Department in November, 1893. An examination having been made and a report submitted in which it was stated that the wreck was such an obstruction to navigation as is contemplated in section 4 of the river and harbor act of June 14, 1880, authority was received to remove it and an allotment of $406.20 made therefor. After the usual notice to owners had been given and advertisements for proposals had been published, five bids were received in response thereto and were opened on December 30, 1893, the contract being awarded to Kelly & Van Sant, of Atlantic City, N. J., the lowest bidders, at $342. The removal was not begun as promptly as was required by the contract, and consequently was not completed until February 23, 1894. The boat, a very old one, was broken up with dynamite, its cargo having been found worthless, and the débris landed on shore, the total expense for its removal being $397.90. The unexpended balance of $8.30 was returned to the Treasury.

Abstract of proposals received by Gen. William F. Smith, U. S. agent, Wilmington, Del., for the removal of the wreck of the canal boat J. D. Hilton, in Christiana River, Delaware.

No.	Name and address of bidder.	Amount.
1	John Austen, Philadelphia, Pa	$387
2	Johnston & Townsend, Somers Point, N. J	860
3	Kelly & Van Sant, Atlantic City, N. J	*342
4	Delaware Construction Company, Philadelphia, Pa	500
5	Jesse A. Gray, Philadelphia, Pa	387

* Lowest; accepted.

Wreck of a coal barge off Popes Island, Virginia.—In January last the agent of the Philadelphia Maritime Exchange, stationed at the Delaware Breakwater, reported that a barge laden with coal had recently sunk near the coast of Virginia, and was forming a dangerous obstruction to navigation. An examination having been ordered and made, it was found to be the barge *Hudson*, bound from Newport News to New York, which had been abandoned in a sinking condition. One of her masts was still standing, and being directly in the track of coasting vessels it was recommended that it be removed at once with the aid of a wrecking steamer to be chartered for that purpose. Authority having been received to proceed in the manner indicated, preparations were just being made for the hire of a boat when authentic reports were received that on the day before, February 1, the U. S. cruiser *Vesuvius* had blown up the entire wreck with dynamite. The expenses incurred in the examination of this wreck were $27.87.

Wreck of canal boat Loring Monroe in Brandywine Creek, Delaware.—On the 28th of May, 1894, the chairman of the board of port wardens of Wilmington, Del., reported that a canal boat which had been sunk in Brandywine Creek two or three years ago, below the railroad bridge, where it did not materially interfere with navigation, had, during recent floods, been moved down the stream into a position where it formed a serious obstruction to navigation. Under instructions from the Chief of Engineers an examination was made, and as the wreck was found to be such an obstruction as is contemplated by section 4 of the act of 1880, authority for its immediate removal was recommended. This was granted and an allotment of $450 made therefor. Proposals were invited by advertisement dated May 31, 1894, and the lowest received, that of Frank C. Somers, of Camden, N. J., to remove the wreck for $275, accepted. Work thereon was begun on June 29, and at the end of the fiscal year was still in progress.

Abstract of proposals received and opened June 15, 1894, by Gen. William F. Smith, U. S. agent, for removal of wrecked canal boat in Brandywine Creek, Delaware.

No.	Name and address of bidder.	Amount.	Remarks.
1	Delaware Construction Co., Wilmington, Del.	$400	
2	Frank C. Somers, Camden, N. J	*275	Commence work on or before July 10, complete in ten days.
3	G. M. Van Sant, Atlantic City, N. J	342	Eighteen days required to remove wreck.
4	Jesse A. Gray, Philadelphia, Pa	328	Remove wreck within thirty days.

* Lowest; accepted.

APPENDIX I.

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND, AND JAMES RIVER, VIRGINIA.

REPORT OF COL. WM. P. CRAIGHILL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Patapsco River and channel to Baltimore, Md.
2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.
3. James River, Virginia.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 9, 1894.

GENERAL: I have the honor to forward herewith the annual reports for the year ending June 30, 1894, for the works of improvement of rivers and harbors which have been in my charge.

During the year I have also been Division Engineer of the Southeast Division and member of several special Boards, and member of The Board of Engineers when matters pertaining to the defenses of points in the Southeast Division were under consideration.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE, MARYLAND.

The river and harbor act of September 19, 1890, contained the following clause:

> *Provided,* That such contracts as may be desirable may be entered into by the Secretary of War for the completion of the existing project, or any part of same, to be paid for as appropriations may from time to time be made by law.

By advertisement of September 30, 1890, proposals were invited for completing the channel, which were received December 2. The contract was awarded to the American Dredging Company, of Philadelphia, at 10½ cents per cubic yard for removal and redeposit, to cover 6,000,000 cubic yards of material. The time for completion of the work was June 1, 1893, but it was finished in December, 1892.

Work under the contract began February 17, 1891, and was completed December 6, 1892. The channel is now 27 feet deep at mean low water, with a width throughout of not less than 600 feet, and more at the turns.

Nothing was done in the fiscal year ending June 30, 1894, except to make a resurvey of the channel, which was found to be in quite good condition.

It should not be forgotten that this channel, like all artificial highways, needs attention and repairs to keep it in order, and the amount of repairs and consequent cost will increase rapidly if not promptly attended to at the proper times, which is *once every year*.

The following are the amounts and dates of appropriations for improving harbor at Baltimore, Md., including Patapsco River:

August 30, 1852	$20,000	March 3, 1879	$160,000
August 15, 1856	100,000	June 14, 1880	100,000
June 23, 1866	5,200	March 3, 1881	150,000
March 2, 1867	75,000	August 2, 1882	450,000
July 25, 1868	17,000	July 5, 1884	250,000
April 10, 1869	26,730	August 5, 1886	150,000
July 11, 1870	42,900	August 11, 1888	300,000
March 3, 1871	50,000	September 19, 1890	340,000
June 10, 1872	100,000	March 3, 1891	151,200
March 3, 1873	200,000	August 5, 1892	208,000
March 3, 1875	75,000		
August 14, 1876	75,000	Total	3,121,030
June 18, 1878	75,000		

Money statement.

July 1, 1893, balance unexpended	$20,612.06
June 30, 1894, amount expended during fiscal year	17,741.37
July 1, 1894, balance unexpended	2,870.69
July 1, 1894, outstanding liabilities	600.00
July 1, 1894, balance available	2,270.69
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

COMMERCIAL STATISTICS.

Commercial statistics of the port of Baltimore, Md, comparing the fiscal years ending June 30, 1893 and 1894.

[Compiled for the use of Col. William P. Craighill, Corps of Engineers, U. S. A.]

Tonnage.	Foreign.		Coastwise.	
	1893.	1894.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Inward	774,399	807,239	1,272,868	1,270,673
Outward	1,112,456	1,121,839	1,447,453	1,553,196

Established lines of steamships.

Name.	Number.	Net tonnage.	Destination.
Atlantic Transport	7	13,853	London.
Lord	11	20,477	Belfast and Dublin.
Hamburg-American	14	28,082	Hamburg.
Earn	5	7,080	Cuban ports.
North German Lloyd	16	68,650	Bremen.
Johnston	7	19,347	Liverpool.
Puritan	4	5,421	Antwerp.
Donaldson	6	11,687	Glasgow.
Blue Cross	6	9,971	Havre.
Slomans	3	4,047	Brazilian ports.
Liverpool, Brazil and River De La Plata	8	10,151	Do.
Buckman's	4	1,717	Port Antonio.
Red Cross	4	4,182	Brazilian ports.
Bristol Channel Line	2	2,620	Bristol.
Neptuno	7	12,322	Rotterdam.
Bulack's	6	2,484	Cuban ports.
Tampico	3	9,000	Tampico, Mexico.
Total	113	231,091	

Value of imports.

1894 (free)	$7,098,683
1893 (free)	7,419,132
Decrease in 1894	320,449
1894 (dutiable)	4,880,217
1893 (dutiable)	8,730,763
Decrease in 1894	3,850,546

RECAPITULATION OF IMPORTS.

1894 (free)	$7,098,683
1894 (dutiable)	4,880,217
Total	11,978,900
Total, 1893	16,149,895
Total decrease in 1894	4,170,995
Imports in American vessels in 1894:	
Sailing	$3,876,496
Steam	84,704
Imports in foreign vessels:	
Sailing	426,717
Steam	7,583,350
Imports in cars overland	7,633
Total	11,978,900

Value of domestic exports.

1894	$78,261,892
1893	71,482,652
Increase in 1894	6,779,240
Exports in American vessels in 1894:	
Sailing	$1,380,688
Steam	119
Exports in foreign vessels in 1894:	
Sailing	126,920
Steam	76,754,165
Total exports in 1894	78,261,892

RECAPITULATION OF EXPORTS.

In American vessels, 1894	$1,380,807
In foreign vessels, 1894	76,881,085

Certain articles exported.

Articles.	Tons.	Articles.	Tons.
Cattle	44,165	Fresh beef	2,436
Corn	258,582	Salt beef	3,209
Wheat	302,026	Tallow	6,789
Flour	294,258	Bacon	4,043
Coal	174,682	Hams	453
Copper matte	7,011	Salt pork	1,348
Copper ingots	19,367	Lard	26,922
Cotton	47,125	Oleomargarine oil	10,510
Dried apples	382	Cotton-seed oil	221
Grape sugar	2,551	Starch	3,788
Oil cake	18,368	Leaf tobacco	26,739
Wax	1,425	Tobacco stems	2,121
Illuminating oil	12,635	Clover seed	6,881
Canned beef	10,168		

Transportation in bond with appraisement.

Destination.	Value.	Duty.	Destination.	Value.	Duty.
Alexandria, Va	$343	$254.82	Milwaukee, Wis	$113	$336.93
Burlington, Iowa	2,899	2,365.40	New York, N. Y	7,803	8,626.03
Chicago Ill	19,377	16,450.95	Peoria, Ill	2,587	2,108.92
Cincinnati, Ohio	1,512	1,214.73	Philadelphia, Pa	10,467	9,162.93
Cleveland, Ohio	1,128	798.40	Pittsburg, Pa	4,165	8,174.59
Denver, Colo	85	68.75	Richmond, Va	260	214.20
Detroit, Mich	2,427	2,215.00	St. Louis, Mo	2,531	2,114.13
Evansville, Ind	1,303	770.90	Toledo, Ohio	3,121	2,304.57
Georgetown, D. C	749	326.30	Wheeling, W. Va	2,467	2,203.65
Indianapolis, Ind	8,059	5,399.46			
Louisville, Ky	1,271	1,015.00	Total	73,423	61,744.14
Memphis, Tenn	756	588.48			

Transportation in bond without appraisement.

Destination.	Value	Bond.	Destination.	Value.	Bond.
Buffalo, N. Y	$1,882	$948.05	Louisville, Ky	$302,958	$838,506.39
Chicago, Ill	628,179	500,785.61	Memphis, Tenn	8,550	20,001.60
Cincinnati, Ohio	174,373	291,282.04	Milwaukee, Wis	24,187	22,200.70
Columbus, Ohio	15,954	9,048.66	Minneapolis, Minn	1,844	1,106.40
Cleveland, Ohio	112,288	72,411.55	Nashville, Tenn	58	116.00
Council Bluffs, Iowa	3,965	9,800.00	Norfolk, Va	25	8.25
Detroit, Mich	11,264	17,869.67	Pittsburg, Pa	4,192	1,652.96
Dubuque, Iowa	1,599	1,599.00	Philadelphia, Pa	514	514.00
Evansville, Ind	5,003	2,710.30	Richmond, Va	6,315	7,572.74
Georgetown, D. C	8,113	6,359.30	St. Louis, Mo	261,810	218,675.25
Grand Rapids, Mich	6,982	3,745.77	St. Paul, Minn	16,310	17,784.40
Indianapolis, Ind	123,238	72,239.49	Toledo, Ohio	21,273	17,717.24
Jacksonville, Fla	243	243.00			
Kansas City, Mo	378	94.50	Total	1,741,497	2,134,992.87

Summary of merchandise transported in bond without appraisement.

Year.	Value.	Bond.
1893	$2,901,200	$2,868,666.15
1894	1,741,497	2,134,992.87
Decrease in 1894	1,159,703	733,673.28

Immigrants and passengers arrived:	
1893	26,183
1894	14,296
Decrease in 1894	11,887
Amount of duties collected in 1894	$2,967,113.68
Miscellaneous customs receipts, 1894	71,574.54
Total receipts in 1894	3,038,688.22
Total receipts in 1893	4,629,199.13
Decrease in 1894	1,590,510.91
Duties on merchandise in bond in 1894	538,596.67
Duties on merchandise in bond in 1893	500,146.89
Increase in 1894	38,449.78

Summary of duties collected in 1894.

Imports and miscellaneous customs receipts	$3,038,688.22
Merchandise in bond	538,596.67
Merchandise transported with appraisement	61,744.14
Total	3,639,029.03

Vessels built.

	Number.	Gross tons.	Net tons.	Value.
Steam	10	3,724.20	2,726.95	$547,500
Sail	10	693.63	658.83	52,700
Total	20	4,417.83	3,385.78	600,200

	Tons.
Vessels entered from foreign ports:	
American—	
Sailing	45,519
Steam	1,164
Foreign—	
Sailing	18,509
Steam	742,047
Total	807,239
Vessels cleared for foreign ports:	
American—	
Sailing	68,159
Steam	2,832
Foreign—	
Sailing	6,467
Steam	1,044,381
Total	1,121,839
Vessels entered in 1894	807,239
Vessels cleared in 1894	1,121,839
Total	1,929,078
Total entered and cleared, 1893	1,886,855
Increase in 1894	42,223

Coastwise tonnage:	Tons.
Vessels entered in 1894	1,270,673
Vessels cleared in 1894	1,553,195
Total coastwise in 1894	2,823,868
Total coastwise in 1893	2,720,321
Increase in 1894	103,547

RECAPITULATION.

Total foreign tonnage, 1894	1,929,078
Total coastwise tonnage, 1894	2,823,868
Total foreign and coastwise, 1894	4,752,946
Total foreign and coastwise, 1893	4,607,176
Increase in 1894	145,770

STATISTICAL RECAPITULATION.

Dutiable imports have decreased	$3,850,763.00
Free imports have decreased	$320,449.00
Domestic exports have increased	$6,779,240.00
Tonnage, foreign and coastwise, has increased ... tons..	103,547
Decrease in duties collected	$1,590,510.91
Increase in duties on merchandise in bond	$38,449.78
Decrease in duties on merchandise in bond, with and without appraisement	$740,737.97

Notwithstanding the widespread depression in the maritime trade of the country there has been an increase in the tonnage movement at this port for the fiscal year ended June 30, 1894, of 4½ per cent over that of the previous year.

We have now 17 established steamship lines trading between this port and foreign ports, representing 113 vessels, with an aggregate carrying capacity of 13,254,460 tons. We sustained a loss of two lines during the year—the Royal Netherlands and the Allan lines—and a gain of one line—the Tampico, Mexican. Our shipbuilding interests show a slight depression as compared with last year. During the year just closed there were built in this district 10 sail and 10 steam vessels, valued at $600,000.

As a result of recent legislation the decrease in immigration is very marked; the arrivals at this port for the fiscal year show a falling off of 54 per cent.

It is to be hoped that the agitation now going on among the shipping people and the various boards of trade relative to the proper lighting of the Craighill Channel with electric lights, will meet with success. It is a matter of great moment to vessels under charter that nothing should intervene to affect the terms of their agreement, which sometimes happens if vessels are detained on account of darkness; but with electric lights properly placed there will be no detention at night. With this added improvement to the facilities that are offered in the way of capacious elevators, few and low port charges, extensive piers, a magnificent harbor, and prompt dispatch, there is no reason why Baltimore should not continue to be the favorite port of entry on the Atlantic coast.

Very respectfully, yours,

Frank T. Shaw, *Collector.*

Col. Wm. P. Craighill,
Corps of Engineers.

I 2.

IMPROVEMENT OF CHANNEL TO CURTIS BAY, IN PATAPSCO RIVER, BALTIMORE HARBOR, MARYLAND.

The river and harbor act of 1892 contained the following item:

Improving Patapsco River, Baltimore Harbor, Maryland: For dredging a channel one hundred and fifty feet wide at bottom and of a depth of twenty-seven feet mean low water from the main ship channel to Curtis Bay, in accordance with recommendation of Colonel William P. Craighill, Corps of Engineers, submitted December thirteenth, eighteen hundred and ninety, twenty-eight thousand dollars.

The total estimated cost of the improvement was $85,000. The first appropriation of $28,000 was expended in dredging to a depth of 25 feet at low water. The work, under a contract with the National Dredging Company, was commenced in November, 1892, and after considerable interruption by ice and severe weather was satisfactorily completed in May, 1893. The channel was made 150 feet wide.

Money statement.

Amount (estimated) required for completion of existing project.......	$57,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	57,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

I 3.

IMPROVEMENT OF JAMES RIVER, VIRGINIA.

The improvement was regularly undertaken by the United States in 1870. A small sum had been previously expended and was of some advantage to navigation. The total expended by the United States to July 1, 1894, has been $1,456,783.14. In addition the city of Richmond has expended nearly $500,000, but in the last five years only about $50,000, and this near the wharves of the city.

When the improvement was undertaken by the Government navigation was obstructed by sunken vessels, by remains of military bridges, and by obstructions put in the river during the late war to prevent the national fleets from approaching too close to Richmond. There were also natural obstructions.

Rockett Reef and Richmond Bar had only 7 feet of water at mean low tide. From Warwick Bar (where the depth was 13 feet) to Richmond the channel was crooked and obstructed by dangerous rocks and ledges. The Dutch Gap Cut-off, which now saves 5½ miles of difficult navigation, was not then open. Sixteen and one-half feet can now be carried to the city at low water, and 18 may be expected by January, 1895.

The original project was to secure a depth of 18 feet at full tide, corresponding to 14.5 feet at low tide, to Richmond, with a channel width of 180 feet from Harrison Bar to Richmond docks, the excavation in rock to be 18½ feet at full tide. This plan was well advanced when Congress, by act approved July 5, 1884, adopted the project of 22 feet at mean low tide from Richmond to the sea. Operations during the past year have been conducted in accordance therewith. In carrying it out further a large amount of excavation will be in solid rock, and the cost will necessarily be great. The width to be given to the channel is 400 feet from the sea to City Point, 300 feet from City Point to Drewry Bluff, and 200 feet from thence to Richmond. The methods employed for improving the river consist in dredging, rock excavation, and the contraction of the waterway by means of dikes or jetties.

Mr. H. D. Whitcomb has been the efficient resident engineer of the work during the fiscal year. His report giving details is appended.

The following are the amounts and dates of appropriation for improving James River, Virginia:

July 11, 1870	$50,000	March 3, 1881	$60,000
March 3, 1871	50,000	August 2, 1882	75,000
June 8, 1872	50,000	July 5, 1884	75,000
March 3, 1873	75,000	August 5, 1886	112,500
June 23, 1874	50,000	August 11, 1888	225,000
March 3, 1875	50,000	September 19, 1890	200,000
August 14, 1876	60,000	July 13, 1892	200,000
June 18, 1878	70,000		
March 3, 1879	75,000	Total	1,552,500
June 14, 1880	75,000		

Money statement.

July 1, 1893, balance unexpended		$181,587.33
June 30, 1894, amount expended during fiscal year		73,907 26
July 1, 1894, balance unexpended		107,680.07
July 1, 1894, outstanding liabilities	$2,000.00	
July 1, 1894, amount covered by uncompleted contracts	69,687.32	
		71,687.32
July 1, 1894, balance available		35,992.75
Amount (estimated) required for completion of existing project		3,336,070.45
Amount that can be profitably expended in fiscal year ending June 30, 1896		400,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. H. D. WHITCOMB, ASSISTANT ENGINEER.

RICHMOND, VA., *July 2, 1894.*

COLONEL: I have the honor to submit the following report of operations connected with the improvement of James River, Virginia, for the fiscal year ending June 30, 1894.

Surveys.—The usual soundings were taken between lines of regulation at the wing dams and more frequently at important points. On rock bottom and in Dutch Gap Cut-off they were taken every 10 feet on lines 20 feet apart. In addition a sweep was run over the bottom in the channel where any material which has required blasting has been excavated in the past year.

Surveys were made of the shoals in Ferry Reach and between Varina and Deep Bottom; at Harrison's Bar and across the bend above Dutch Gap Cut-off Several areas were surveyed for information in connection with the construction of models of the river and adjoining land.

Models of Goodes Rocks Ledge and of Randolph Flats in 1874 and 1893 were made, the latter including the adjoining land for an avervge of 2,000 feet each side of the river. A model is well advanced showing the river and surroundings from Drewry Bluff to half a mile below Dutch Gap.

Tidal observations.—A registering tide gauge has been in operation at the lower city limits during the year, and another at Dutch Gap since November 1, 1893.

Freshets, etc.—There were no heavy rises in the river to produce scour between the older works of regulation. The following are all that exceeded the ordinary stage by about 2 feet and over:

At Richmond.	Above zero	Above mean high tide.	At Richmond.	Above zero	Above mean high tide.
	Feet.	*Feet.*		*Feet.*	*Feet.*
August 5, 1893	5.59	1.99	October 15, 1893	12.93	9.33
August 31, 1893	12.30	8.70	October 24, 1893	14.51	10 91
September 15, 1893	14.63	11.03	February 7, 1894	6	2 40
October 6, 1893	6.48	2 88	March 4, 1894	6 50	2.90

A very high tide, due to a strong easterly wind, occurred October 13, rising to 7.82 feet above zero and 4.22 feet above mean high tide. This is the highest due to wind recorded in this office. The highest from a similar cause recorded previously was 6.90 above zero, April 10, 1877.

The mean results of registered observations at Richmond and Dutch Gap are as follows:

All tides observed.

Locality and period.	Number of observations.	Lunitidal interval (Richmond local time).		Height above zero.		Rise and fall.	Mean tide above zero.
		High tide.	Low tide.	High tide.	Low tide.		
		h. m.	*h. m.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Marine Railway Wharf, Richmond, April 1, 1893, to May 31, 1894	781	4 11	11 46	4.19	0.90	3.29	2.55
Lower entrance Dutch Gap Cut-off, November 1, 1893, to May 31, 1894	402	3 36	10 40	3.37	.04	3.33	1.71

Omitting tides which exceed 1.4 feet above or below mean high or low tide.

Locality and period.	Number of observations.	Lunitidal interval (Richmond local time).		Height above zero.		Rise and fall.	Mean tide above zero.
		High tide.	Low tide.	High tide.	Low tide.		
		h. m.	*h. m.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Marine Railway Wharf, Richmond, April 1, 1893, to May 31, 1894	623	4 07	11 37	3.84	0.14	3.70	1.99
Lower entrance Dutch Gap Cut-off, November 1, 1893, to May 31, 1894	385	3 36	10 38	3.32	.04	3.36	1.64

The lunitidal interval is from the next preceding transit of the moon at Washington. The zero is the assumed mean low tide at Richmond as found from observations taken nearly twenty years since, and is the same for both stations, so far as is known by lines of levels run in 1877.

Comparing observations at these stations for the same period, November 1 to May 31, excluding tides affected by high winds or high stages of the river, high tides at Richmond were 33 minutes and low tides 61 minutes later. From observations taken in the same way from September, 1875, to June, 1876, at approximately the same places, high tides at Richmond were 47 minutes and low tides 73 minutes later, an apparent shortening of 14 minutes in the time of tidal propagation in eighteen years. A longer series of observations may modify this apparent result, but some such effect was expected from the deepening of the channels and the enlargement of Dutch Gap Cut-off in the intervals.

The two stations are 14 miles apart by river (via cut-off), and 10 miles in a direct line, the Richmond station being in about 3½ minutes more west longitude. The mean heights of ordinary tides in this period, November 1 to May 31, show a fall between Richmond and Dutch Gap of 0.447 foot at high tide and 0.165 foot at low tide, the mean stage of river at Richmond being 0.104 foot higher than the assumed yearly stage at mean tide.

In the same periods mentioned the rise and fall of tides were:

	1875-'76.	1893-'94.	Difference.
	Feet.	*Feet.*	*Foot.*
At Richmond	3.49	3.70	+0.21
At Dutch Gap	3.29	3.36	+0.07
Difference	0.20	0.34	....

The stage of the river at Richmond at mean tide was 0.299 foot higher in 1893-'94 than in 1875-'76.

The rise and fall of tide decreases with higher stages of the river, but this statement shows directly the reverse. As with the decrease in the time of propagation, such increase in the rise and fall was expected from the improved condition of the river, but a longer series of observations is desirable to confirm or modify the amount given in the statement.

THE PROJECT OF IMPROVEMENT.

Some work was done between 1852 and 1855 by the United States, and by the city of Richmond, under the direction of Col. De Russy, in the removal of dangerous rocks and maintenance of somewhat deeper water over the bars. The city continued this work at intervals up to 1861. The first appropriation made by the United States after this was $50,000 in 1870. The city appropriated $250,000 in the same year, a large part of which was expended in dredges and other plant.

The operations of the United States were first directed to the removal of military bridges and other obstructions of that character, so as to restore a navigable channel equal to that existing prior to 1861. This was followed by the opening of Dutch Gap Cut-off to navigation, and a careful survey of the river between Richmond and Varina, a distance of about 20 miles, where the most serious bars and ledges are found.

The systematic improvement of the river may be considered as beginning in 1870, when 7 feet at low and 10½ feet at high tide were the full depths available for navigation at Richmond, and for nearly 20 miles below, in a channel narrow and tortuous from obstructions of sunken cribs and vessels.*

The depths available to the city prior to 1861 were about the same, 14 feet being available 20 miles below.

The first project of improvement was to secure 18 feet at full tide in a channel 180 feet wide. The regulation of the river by dikes and wing dams, and the excavation in rock and other hard material, conformed to this plan until 1879, when the project was amended to make the depth 18 feet at low tide below Warwick Bar, 5 miles from the city. The dredging done at several points from Dutch Gap to Jamestown in 1880-'81 was in accord with this later plan, and the works of regulation constructed at Varina Shoal in 1880 were intended to produce that depth.

An elaborate survey of the whole river below Richmond where the depths were less than 25 feet at full tide was made in 1881, in compliance with a resolution of Congress directing a report on the practicability and cost of deepening the channel from the sea to Richmond to 25 feet at full tide. This survey included borings in the river bed to at least that depth, or to solid rock.

The report and estimate on this project was submitted in 1882, and Congress adopted the project in 1884.

Since then the work has been prosecuted toward that end, i. e., to 22 feet at low tide, with a channel varying in width from 200 feet at Richmond to 400 feet below City Point.

WORK NOW IN PROGRESS.

The existing contract for work was entered into with Mr. John A. Curtis, approved October 20, 1892, and expires December 1, 1894. Its object was to open a practicable channel from the sea to Richmond city limits, not less than 18 feet deep, in furtherance of the project of 22 feet.

The least width in rock excavation was to be 80 feet; at other points, except in Dutch Gap Cut-Off and below City Point, the improvement by regulation only was intended to produce the channel of the full project. The channels below City Point, heretofore made 18 feet deep or more, and 200 feet wide, were to be cleaned out, and the channel in Dutch Gap Cut-off made 25 feet deep and 100 feet wide.

At the close of the last fiscal year the contractor had completed the extension of wing dams between Richmond Bar and Drewry Bluff, and begun new dams in Wards Reach. He had closed the gaps left in the dikes at Kingsland in 1891, and dredged a considerable part of the channel between the city limits and the lower end of Richmond Bar. Some drilling and blasting had been done in Goodes Rocks Ledge, and in shallow rock cutting between the city limits and the Chesapeake and Ohio Railway wharves.

WORK DONE DURING THE PAST FISCAL YEAR.

Richmond to Stearns Dike.—The work on this section was continued with one dredge until the end of September, with an interruption of seventeen days in August. Dredging was resumed April 11 and continued until close of May. Two days' work were done in June. A drilling force was employed here twenty days in August, thirty days in March and April, and thirteen days in June. About 30,000 square feet of shallow cutting remains on this section below the Richmond Chemical Works, and the same amount above them, some of which require blasting. No work has been done on this contract above these works, which are about 600 feet below the point assumed as city limits.

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* All measurements which vary with the stage of tide are referred to *mean low tide*, unless otherwise stated. Full tide is mean high tide.

In the main, the section below the works has the required depth of 18 feet. The area with deficient depth is about 15 per cent of the section below the works.

Stearns Dike to Goodes Rocks.—A dredge was employed here from July 1 to September 30. About 66,000 square feet of shallow cutting remain in hard material where more or less blasting is required, or about 25 per cent of whole area. The remaining part of the section has the required depth.

Goodes Rocks.—This ledge is the most formidable obstacle to an increase in the navigable depth of the river below the city limits. It is 1,400 feet long, 800 of which is in hard granitic rock. A cut 55 feet wide was made in the harder part to the depth of the project under previous contracts, but this cut is distinct in position from the channel now and heretofore used for navigation. This cut is being made 80 feet wide under the contract in force, and will then adjoin the present channel, encroaching on it in places, and will be wide enough to be used by vessels.

Because navigators have of necessity continued to use the old channel, no increase in available depth at this point has been reported since the last project was adopted, or for more than ten years, although there has been an increase in width and depth of channel elsewhere above Richmond Bar, which lies directly below the ledge.

A drilling force was employed in widening the cut from July 1 to November 30, except for twenty-three days in July. Work was resumed April 12 on the lower part and has continued up to date, two forces being employed part of the time. There remain 15,280 square feet of surface on this part of the ledge, and 8,750 square feet on the harder part to be drilled or redrilled. Fifty thousand square feet were drilled over in the past year, 73 per cent of the amount required to be done. The larger fragments of blasted rock were removed by a hoisting machine, at intervals, as required; the remainder is being removed by dredges. Seventy-two days' work of one dredge were done between July and December, and twenty-six days in April and June. About 7,000 cubic yards of material remain to be excavated to satisfy the requirements of the contract.

Richmond Bar.—No excavation was done on this section during the year. There are 76,000 square feet of surface where the dredges employed in the previous year failed to get the full depth required and where some blasting will be needed. This is 27 per cent of the whole area of the section.

Dutch Gap.—Work was begun here with a dredge October 1. This was discontinued at the close of the month and blasting tried to loosen the indurated earth forming the bed of the Cut-off. Two rotary drills with steel cutters were used sixteen days in November and twenty-four days in December. Dredging was resumed November 23 and continued to the end of March. In the interest of navigation and for other reasons it was found judicious to change the plan from a channel 100 feet wide and 25 feet deep to one 140 feet wide and 22 feet deep, and but a small area was excavated to the former depth. The results of blasting were not so favorable as they had been in this material in former years, due, perhaps, to the explosive used; and several small areas with less than 22 feet depth remain to be moved. There are yet about 400 cubic yards of the amount stated in the contract remaining. A sweep run over the work in April showed a channel more than 18 feet deep, 140 feet wide throughout the Cut-off. The points above 22 feet are of small area and many may be loose lumps from dredging, which would be swept out by a strong current. This channel is now better than ever before.

Harrisons Bar and Goose Hill Flats.—Nothing has been done on this part of the contract. The contractor expects to have one or more dredges at work at an early day.

Wing dams and dykes.—The wing dams in Wards Reach were completed in July, and those in Willis Reach in August. The force was moved to Curles Neck and continued to November 4. Owing to delays in furnishing material for revetment from Dutch Gap the force was removed from Curles Neck and closed gaps in training walls between Richmond Bar and Drewry, left when they were constructed. This was completed November 18. The force was then taken to Varina and restored the two wing dams on the left bank, built in 1880, but shortened in the freshet of 1886 and at subsequent times. These were completed in November. The force was again employed at Curles Neck until December 16, and returned to Varina and remained to March 19, constructing new wing dams on the right bank. The remainder of March was spent in completing the work at Curles Neck.

No more work on wing dams is required under the contract except the important one of adding to the revetment required during the construction of wing dams, the additional amount to be had from all suitable material excavated between Richmond and Dutch Gap, as required by the contract. The dams below Drewry, and especially at Curles Neck, are in comparatively deep water and built in soft bottom, and need the additional stability this material will give them.

AMOUNT OF MATERIAL EXCAVATED.

The amount excavated in the past fiscal year, the total amount excavated to date, and the estimated amount remaining to be done under the contract, are as follows:

Excavated in the fiscal year.	Earth.	Cobble.	Soft rock.	Solid rock.	Total.
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
Richmond to Stearns Dyke	1,577.6	51.6	6,556.8	1,801	9,987
Stearns Dyke to Goodes Rocks	1,932.8	64.3	5,722.6	200.9	7,920.6
Goodes Rocks	489.8	14	954.8	2,299.8	3,758.4
Dutch Gap Cut-off	11,589.6	....	....	....	11,589.6
Total	15,589.8	120.9	13,234.2	4,301.7	33,255.6

The amount of cobble found has been greatly less than was estimated and the soft rock correspondingly larger.

POSITION AND LENGTH OF WING DAMS BUILT IN THE FISCAL YEAR.

It was found necessary to replace certain parts of the dams at Curles, using longer and stouter piles. The two dams on the left bank at Varina were still more shortened by some cause, perhaps the ice of 1892–'93. From these and other causes the length of dams required by the contract has been exceeded 12.3 per cent.

The following statement gives the length of wing dams built.

Wards Reach.			Willis Reach.			Varina.				Curles Neck.		
No. of wing dam.	New wing dam.	Average depth of water	No. of wing dam.	New wing dam.	Average depth of water.	No. of wing dam.	New wing dam.	Old work renewed.	Average depth of water.	No. of wing dam.	New wing dam.	Average depth of water.
	Lin. ft.	*Feet.*		*Lin. ft.*	*Feet.*		*Lin. ft.*	*Lin. ft.*	*Feet.*		*Lin. ft.*	*Feet.*
209	109.8	3.5	252	170.1	4	509	193.1	....	7	615	405.1	12
210	106.2	4.5	254	169.4	6.5	511	262.2	....	8	617	446.8	13.3
211	200.4	9.5	256	213.9	6.6	513	295.7	....	10	618	93.4	8.5
212	68.8	3	258	254.7	9.3	515	304.4	....	11.7	619	397	14.2
213	243.7	7.2	259	99	6.5	516	....	93.2	12.4	621	309.9	12.1
214	82.4	6	260	224.6	9	517	282.9	....	11.6	622	268.6	11.8
215	241	6	......	....	....	518	....	172	11.3	623	197.6	8
216	82.6	4	......	....	....	519	240.1	....	7.7	625	146.9	8.5
						521	227.9	....	9.5	626	589	9.4
						523	272.6	....	7		....	....
						525	124.9	....	7.7		....	....
	*685.4	....		1,131.7	....		2,203.8	265.2	....		2,854.3	....

* Less 449½ feet reported last year

	Feet.
Total wing dams built in the fiscal year	7,140.4
Renewals and repairs in the fiscal year	531.3
Reported July 1, 1893	2,823.5
Total wing dams constructed under contract	10,495.2
Original estimate	9,340
Excess 12.3 per cent	1,155.2
Closing gaps in dikes—	
This fiscal year	950.2
Reported July 1, 1893	447
Total under this contract	1,397.2
Original estimate	1,503
Deficiency 7 per cent	105.8

The larger of the freshets mentioned heretofore in this report produced current enough to cause some scour between the recently constructed works; and the effects of tidal currents is noticeable in those more remote from Richmond. This has hardly been perceptible within 7 miles of the city, obscured, perhaps, by the greater fluvial action.

Effect of currents where contraction was made since 1892.

Locality.	October, 1892.		April, 1894.		When contraction was made.
	Mean depth.	Available depth (80 feet wide).	Mean depth.	Available depth (80 feet wide).	
	Feet.	*Feet.*	*Feet.*	*Feet.*	
Warwick Bar	14.4	17.3	16	18	May, 1893.
Falling Creek	15.9	16.4	17.8	18.3	Do.
Wards Reach	14	16.8	19.4	19.7	June, 1893.
Willis Reach	15.1	16.5	16.4	17.8	Aug., 1893.
Varina	14.5	16.7	16.1	16.2	Mar., 1894.
Curles Neck	14.1	14.7	15.6	16.6	Nov., 1893, to Mar., 1894.

An examination at Varina and Curles Neck in June showed minimum depths:

	Mean.	Available (80 feet wide).
	Feet.	*Feet.*
At Varina	16.72	16.70
At Curles Neck	16.70	17

This increase in less than three months is due to tidal scour, as there was no rise in the river at Richmond worthy of mention in the interval.

There is a fair prospect that all these shoals, which are at cross-overs of the current between deeper water above and below, will be scoured to more than 18 feet by the close of 1894.

The amount of scour and deposit between the works of regulation below Richmond Bar from October, 1892, to April, 1894, is approximately as follows:

Locality.	Length.	Scoured.	Deposit.	Contraction.	Per cent of surface.	When contracted.
	Feet.	*Cubic yds.*	*Cubic yds.*	*Sq. feet.*		
Randolph Flat	3,340	3,978	2,705			No change.
Randolph Flat to Warwick Bar.	3,361	33,062	568			Do.
Warwick Bar	4,841	45,762	295	330,100	*13.5	May, 1893.
Falling Creek	1,747	18,034	3,585	264,600	*16.7	Do.
Falling Creek to Drewry Bluff.	4,404		24,866			No change.
Wards Reach	1,370	10,522		254,000	27.2	June, 1893.
Willis Reach	2,100	18,210		317,500	20.2	August, 1893.
Varina	2,581		4,754	704,000	21	March, 1894.
Curles Neck	2,465	35,398		887,000	29	November, 1893, to March, 1894.
Total		164,966	36,773			

* In addition to former contraction.

In the above table two sections show an excess of deposit. From Falling Creek to Drewry is a deep and sharply curved section, which has at its lower end the remains of obstructions not removed in 1871-'72. These have but 18 feet on them, while the channel for half a mile above and below has from 25 to 30 feet. At Varina the recent contraction had just been completed at the time of survey, which showed that deposits following the injury to the wing dams in 1886 had not ceased, or that the deposit since the survey of 1890 had not been entirely removed. Examinations in June show that a scour is now in progress.

The limiting width and depth on all the sections, except perhaps between Falling Creek and Drewry Bluff, has improved, although there have been no heavy freshets during the past fiscal year.

Following your suggestion, an examination was made of the deposits on the area covered by the wing dams built in 1880, on the left bank at Varina. The current here crosses from the left to the right bank. The two upper dams were shortened an average of 133 feet by freshets in 1886 and later. The deposit found in April, 1894, in rear of the dams, measured 201,500 cubic yards, an average deposit of 8.8 feet on the remaining surface in thirteen years, or nearly 0.7 feet yearly. The scour in the channel caused by these dams was 281,690 cubic yards in the same interval, equivalent to an increase in mean depth of channel 3.62 feet. The dams were intended to produce a depth of 18 feet on this shoal, and the least channel in 1884 was more than 19 feet. In 1890 the depth opposite the injured works had shoaled to 16.7 feet, and in March, 1894, to 16.2 feet. Elsewhere the depth was from 19 to 24 feet. The new dams added in March make the area now cut off 21 per cent.

It may be of interest to have on record the amount of deposit found in Dutch Gap Bend by a survey in July, 1892. In the report of July 1, 1892, the deposit made in this bend between 1874 and 1887 was given as 5,325,115 cubic yards, or 47¾ per cent of the whole volume of water in the bend in 1874. By the survey of July, 1892, the deposit, exclusive of 394,730 cubic yards from excavations dumped in the bend, was 6,929,311 cubic yards, nearly 58½ per cent of the volume of 1874. This deposit was made in eighteen and one-fourth years, and is an average of 0.7 feet yearly, the same as found at Varina. The deposit in the bend is due to the diversion of a large part of the river by the cut-off. The bend is no longer navigable throughout at low tide for craft drawing 4 feet.

The shoal in Ferry Reach, 11 miles, and that between Varina and Deep Bottom, 17 miles from the city, are found about as in 1891, with barely more than 18 feet depth of water. A suitable contraction of surface should give the full channel required in both cases.

The depths of the river at mean low tide in 1870 and 1894 in a channel not less than 80 feet wide are as follows:

	Miles.	1870.	1894.
		Feet.	*Feet.*
Richmond to Goodes Rocks	2	8	16
Goodes Rocks	.25	7	13.8
Richmond Bar	.75	7	16
Richmond Bar to Drewry Bluff	3.75	9	18
Drewry Bluff to Curles	14	7	16.7
Curles to Hampton Roads	80	14.8	17
Total	100.75		

A cut 20 feet deep 55 feet wide is completed through Goodes Rocks Ledge, and being widened to 80 feet under the existing contract. Owing to this unfinished cut, which is to be completed in November, no greater available depth from the sea to Richmond can be reported. The channel elsewhere, above City Point at least, would permit vessels of somewhat greater draft than last year. The completion of the existing contract will give a channel of practicable width at least 18 feet in depth. The present available depth for navigation at full tide is 19½ feet from the sea to Richmond Bar, and 16½ feet thence to the city limits.

No work has been done on the river within the limits of the city of Richmond by the United States during the year.

Very respectfully, your obedient servant,

H. D. WHITCOMB,
Assistant Engineer.

Col. W. P. CRAIGHILL,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

[Richmond, Va., custom-house report.]

*Vessels, steam and sail.**

Year ending—	Cleared.	Entered.	Tonnage.		Value of—	
			Cleared.	Entered.	Exports.	Imports.
June 30, 1893	458	496	392, 185	396, 595	$100, 269	$21, 096
June 30, 1894	438	438	578, 416	578, 416	53, 226	12, 320

* Vessels varied in draft from 6 to 17 feet.

	Tons.
Shipped from other points on the river, excluding Richmond:	
Grain	7, 682
Hay, shucks, and straw	1, 265
Railroad ties	30, 329
Cordwood	74, 812
Lumber	85, 699
Bricks and tiles	5, 250
Miscellaneous	35, 058
Total	240,095
Received at other points on the river, excluding Richmond:	
Coal	240
Lumber	235
Fertilizers	5, 852
Miscellaneous	35, 967
Total	42, 294
Shipped from Richmond:	
Flour	1, 167
Coal	10, 000
Fertilizers	7, 920
Iron	19, 152
Tobacco	539
Granite	7, 350
Lumber	1, 200
Railroad ties	27, 668
Miscellaneous	24, 658
Total	99, 654
Received at Richmond:	
Coal	65, 000
Lime, cement, and plaster	16, 655
Fertilizers	19, 125
Ice	23, 000
Grain	1, 780
Received at Richmond—Continued.	**Tons.**
Lumber	25, 000
Salt	3, 200
Iron	6, 436
Bricks	2, 690
Miscellaneous	71, 340
Total	234, 226
Totals, points on the river and Richmond:	
Shipped—	
Grain	7, 682
Hay, shucks and straw	1, 265
Railroad ties	57, 997
Cordwood	74, 812
Lumber	86, 899
Bricks and tiles	5, 250
Flour	1, 167
Coal	10, 000
Fertilizers	7, 920
Iron	19, 152
Tobacco	539
Granite	7, 350
Miscellaneous	59, 716
Total	339, 749
Received—	
Coal	65, 240
Lime, cement, and plaster	16, 655
Fertilizers	24, 977
Ice	23, 000
Grain	1, 780
Lumber	25, 235
Salt	3, 200
Iron	6, 436
Bricks	2, 690
Miscellaneous	107, 307
Total	276, 520

APPENDIX J.

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON WESTERN SHORE OF CHESAPEAKE BAY.

REPORT OF MAJ. CHAS. E. L. B. DAVIS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Potomac River, at Washington, D. C.
2. Anacostia River, at Washington, D. C.
3. Occoquan Creek, Virginia.
4. Aquia Creek, Virginia.
5. Nomini Creek, Virginia.
6. Lower Machodoc Creek, Virginia.
7. Patuxent River, Maryland.
8. Rappahannock River, Virginia.
9. Urbana Creek, Virginia.
10. York River, Virginia.
11. Mattaponi River, Virginia.
12. Pamunkey River, Virginia.
13. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 5, 1894.

GENERAL: I have the honor to forward herewith my annual reports for the year ending June 30, 1894, on river and harbor works in my charge.

Very respectfully, your obedient servant,

CHAS. E. L. B. DAVIS,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF POTOMAC RIVER, AT WASHINGTON, DISTRICT OF COLUMBIA.

GENERAL DESCRIPTION AND ORIGINAL CONDITION.

The Potomac River is 113 miles in length from its mouth to Georgetown, its present head of navigation for sailing vessels. At Washington it changes its character from a distinctively fluvial to a tidal stream. The tide rises as far as Little Falls, 3 miles above Georgetown, but the flood current is not perceptible above Georgetown. At Little Falls, the actual head ot navigation, the width of the river during low stages is 150 feet, gradually increasing to 1,200 feet at the Aqueduct bridge, while the depth between these points ranges from a ruling depth of 15 feet to a maximum of 85 feet. Here the bed of the river is rocky, while the banks are high and precipitous.

The Aqueduct bridge crosses the river at Georgetown, having 9 spans resting on 8 piers and 2 abutments. Each span affords a clear waterway of about 105 feet. The south abutment on the Virginia side projects into the river 500 feet from the general line of the high banks above and is a serious obstruction to the flow of freshets. The piers and abutments were built from 1834–'40. The rubble masonry of which the piers were built has now deteriorated, so that two of the piers have recently been partly undermined by freshets. In 1887–'88 the superstructure of this bridge was rebuilt, and the former wooden superstructure, which carried the trunk of the Alexandria Canal, was replaced by an iron Pratt truss highway bridge. The bridge has no draw, and therefore limits the passage of sailing vessels to the river below. The lower chord of the bridge affords a clear head room of 30 feet at low tide, and tug boats pass freely under the bridge.

Below the Aqueduct bridge, along the water front of Georgetown, the width of the river gradually decreases for a distance of one-half mile to the foot of Thirty-first street, where the width is 730 feet. The maximum depth increases from 23 to 38 feet, but the low-tide cross section remains about the same as at the Aqueduct bridge, or 22,500 square feet. Here the flood current first begins to be manifested by an upstream movement. This part of the river is known as Georgetown Harbor, and its navigation was formerly obstructed by several dangerous rocks, which were removed in 1876 and 1883–'85. The depth made over these rocks was 20 feet at low tide, which is now the ruling depth in the harbor. Georgetown has a wharf frontage of 4,000 feet, extending from the Aqueduct bridge to the mouth of Rock Creek. Here the river makes a sharp turn of 75 degrees to the right, the city of Washington being on the left bank. On the right is Analostan Island, while between this island and the Virginia shore is a subsidiary channel, from 400 to 800 feet wide, known as Little River, through which a part of the Potomac formerly flowed, and which was in 1792 the main channel to Georgetown. It is now closed by a causeway (built in 1806) at the upper end and a dam at the lower end of the island. During high freshets the river overflows this causeway and Little River then aids in the discharge of freshets, thereby diminishing their height in Georgetown.

From the mouth of Rock Creek the river flows in a southerly direction to Easbys Point, 1 mile below the Aqueduct bridge. At Easbys Point the width is 974 feet, the maximum depth 35 feet, and the low-tide sectional area 17,341 square feet. Prior to the inception of the present plan of improvement in 1881, the river, turning to the southeast, suddenly expanded at Easbys Point from a width of 974 feet to a width of about 6,000 feet off the foot of Seventeenth street, about four-fifths of a mile below, and substantially this last-named width obtained to Giesboro Point, nearly 4 miles below Easbys. The result of such a sudden expansion in width was a rapid deposition of the large amount of sediment borne in suspension by the river, and the consequent formation of a bar in the channel and wide flats on the left bank where the deep indentation to the mouth of Tiber Creek at Seventeenth street caused slack water and favored the deposition of silt. There were in 1792 three channels in this part of the river, but since 1834 there have been but two channels, viz, the main channel, formerly called the Georgetown Channel, but now known as the Virginia Channel, and the Washington Channel. The Long bridge crosses both channels 1⅕ miles below Easbys Point, extending from the foot of Maryland avenue to Alexanders Island on the right bank of the river. The Virginia Channel was obstructed by two bars. The upper bar commenced about one-half mile below Easbys Point and extended to the Long bridge. The ruling depth on this bar in 1857 was but 8 feet, while in 1871 it was but 10 feet. In 1878 13½ feet could be carried over the bar, and in 1881 the ruling depth had increased to 15 feet. This improvement was due to frequent dredging, but after each freshet the dredged channel was nearly obliterated. The lower bar, 3,200 feet long, was near Giesboro Point, and in 1874 had a ruling depth of 14 feet, which was increased by dredging in 1874–'75 to 16 feet; this continued to be the ruling depth in 1881. These bars, especially the upper one, were the source of great delay and obstruction to navigation. Georgetown, where is situated the outlet of the Chesapeake and Ohio Canal, had a large coal trade, and vessels engaged in this trade often grounded on the bar and were obliged to remain there several days. Between these two bars the Virginia Channel was about 800 feet wide, while the depth ranged from a ruling depth of 20 feet to a maximum depth of 30 feet.

The Washington Channel had been cut off from the present Virginia Channel in 1834 by shoaling, and in 1878 had practically no existence above the foot of D street SW. From the Long bridge up to this point 8 feet could be carried, but this part of the channel was used only by wood vessels of light draft. Below the Long bridge the Washington Channel was very shoal, the ruling depth in 1878 being 10 feet for the greater part of the wharf front, which is 1 mile in length. Off the foot of N street S. the depth increased to 12 feet, gradually deepening to 22 feet off Greenleaf Point at the end of the U. S. Arsenal grounds. At this point the Anacostia River or Eastern Branch enters from the left, while the Washington and Virginia channels unite at Giesboro Point, three-fourths of a mile below. The depth in the Washington Channel was entirely insufficient for the trade of the port, and its condition was a source of great annoyance and delay to vessels and of increased expense to merchants. Shipments of ice, coal, and other similar merchandise could only be made in light-draft vessels, and consequently at increased freight rates. The grounding of vessels in the channel was of frequent occurrence. The depth in the Washington Channel had, however, been increased by dredging so that in 1881 16 feet could be carried along the greater part of the wharf front, thus affording material relief.

The lower water cross section of the Virginia Channel at Long bridge was 21,051 square feet and of the Washington Channel 4,662 square feet, a total of 25,713 square feet. At Greenleaf Point the combined cross section of the two channels was 24,000 square feet.

The flats, which, under the conditions above noted, had been in gradual process of formation for nearly a century, extended above the Long bridge from the Washington shore to the edge of the Virginia Channel. Between Easbys Point and the old Seventeenth street wharf, a considerable area, in some places 1,500 feet wide, had been raised by accretions to a height of a foot or less above mean low tide. On the remainder of these flats the depth ranged generally from less than a foot to about 2 feet at low tide. Below the Long bridge the flats were between the Washington and Virginia channels, and the depth of water upon them ranged from about 1 foot at the Long bridge causeway to 4 feet near the junction of the two channels. In 1881 all the flats above as well as below the Long bridge were overflowed at every mean high tide, and were then crossed in ordinary row boats.

The B street sewer discharged at the foot of Seventeenth street, and although a canal had been dredged through the marsh to the edge of the Virginia Channel large quantities of sewage were carried out of the canal at high tide and distributed over the flats among the rank growth of sedges and aquatic plants with which they were there covered. As the tide fell this mass of sewage was left exposed to the rays of the sun. These conditions combined not only to generate an effluvium which became an intolerable nuisance, rendering the adjacent portions of the city almost uninhabitable, but also to cause malarial and other diseases, thereby greatly endangering the health of the city. Below the Long bridge a large number of sewers discharged into the Washington Channel, and the flats here were rapidly growing and approaching the condition of those above the bridge.

The mean range of tides at Washington is 3 feet. The tides are much affected by the winds. Northwest winds cause low tides, while south and east winds cause high tides. The lowest tide recorded is 4.8 feet below and the highest 8.8 above the plane of mean low tide.

Freshets occur at irregular intervals following heavy rains in the Potomac and Shenandoah valleys. Ordinary freshets rising to about 6 feet are liable to occur several times a year. High freshets occur at intervals of several years. The freshet of November, 1877, was the highest recorded up to that date. The water then reached a height of 16.5 feet above low tide at the Aqueduct bridge, 13 feet at the foot of G street, NW., 10.2 feet at the foot of Seventeenth street, 9.1 feet at the Long bridge, and 8.4 feet at the U. S. Arsenal grounds or Greenleaf Point. The plans for the improvement were largely based upon results of this freshet, but during the progress of the work in June, 1889, a still higher one occurred, rising from 3 to 3½ feet above that of 1877. The maximum height in 1889 at the Aqueduct bridge was 19.5 feet, at Easbys Point 13.3 feet, at Seventeenth street 13.3 feet, at Long bridge 12.7 feet, and at Greenleaf Point 11.1 feet.

PLAN OF IMPROVEMENT.

The proposed plan of improvement adopted by the act of Congress of August 2, 1882, has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the purification of the water in the Washington Channel, and the establishment of harbor lines, beyond which no wharves or obstructions shall be built.

To accomplish these purposes such depths of channels are to be provided as will accommodate the largest vessels that can reach Arsenal Point, with such depths at the wharves as will allow vessels to receive full cargoes without grounding at low water. The depth of these channels has been established at 20 feet at low tide. The flats above Long bridge are to be filled in to a height of 3 feet above the flood line of 1877; below Long bridge the middle line of the flats is to be filled up to the same height, but the flats are to slope each way to a height of 6 feet above low tide at the margin of the fill. In order to purify the water in the Washington Channel, cut off at its upper end from the Virginia, or main channel, a tidal reservoir or basin was to be established above Long bridge not less than 8 feet deep and provided with inlet and outlet gates of ample dimensions automatically arranged for filling the reservoir on the flood tide from the Georgetown Channel to the level of high water, and emptying it into the Washington Channel to the level of low water during each oscillation of the tide; an ample system of drainage for the reclaimed area was to be provided.

The project also provides for the rebuilding of the Long bridge at an early period during the progress of the improvement, with wide spans upon piers offering the least possible obstruction to the flow of water and the interception of all sewage now discharged into the Washington Channel and its conveyance to the James Creek sewer canal; but neither of these two works was included in the estimated cost of the improvement, which is $2,716,365.

For convenience of designation and reference the area to be reclaimed under the above project of improvement has been divided into three sections, as follows:

Section I comprises the reclaimed area between Easbys Point and the sewer canal at the foot of Seventeenth street NW. Section II comprises the reclaimed area and the tidal reservoirs lying between the sewer canal and the Long bridge. Section III comprises all of the reclaimed area below the Long bridge lying between the Washington and the Virginia channels.

AREAS.

The following is a summary of the areas of the several portions of the reclaimed area of the Potomac River improvement:

Area of Potomac Flats.

	Acres.
Total area (including reservoirs):	
Section I	134.81
Section II	277.08
Section III	327.53
Total area	739.42
Area of reservoirs:	
Large tidal reservoir	111.17
Small tidal reservoir	7.13
Total of reservoirs	118.30
Total area as above	739.42
Deduct area of reservoirs	118.30
Total area of land	621.12

KIDWELL'S MEADOWS.

The first appropriation for improving the Potomac River was by act of Congress of August 2, 1882, and was as follows:

> Improving the Potomac River in the vicinity of Washington with reference to the improvement of navigation, the establishment of harbor lines and the raising of the flats, under the direction of the Secretary of War and in accordance with the plan and report made in compliance with the river and harbor act approved March third, eighteen hundred and eighty-one, and the reports of the Board of Engineers made in compliance with the resolution of the Senate of December thirteenth, eighteen hundred and eighty-one, four hundred thousand dollars.
>
> And it is hereby made the duty of the Attorney-General to examine all claims of the title to the premises to be improved under this appropriation and see that the

rights of the Government in all respects are secured and protected; and if he deems it necessary he is authorized to cause a suit or suits in law or in equity to be instituted, in the name of the United States, in the supreme court of the District of Columbia, against any and all claimants of title under any patent which in his opinion was by mistake or was improperly or illegally issued for any part of the marshes or flats within the limits of the proposed improvement.

In December, 1869, a patent had been issued to John L. Kidwell for certain land in the Potomac River, which land is the so-called "Kidwell's Meadows." The second clause in the appropriation for this improvement was instituted to cover this and all similar claims.

The river and harbor act of July 5, 1884, contained no proviso, but that of August 5, 1886, contained the following:

Provided, That no part of the sum hereby appropriated shall be expended upon or with reference to any place in respect of which the title of the United States is in doubt, or in respect to which any claim adverse to the United States has been made.

The following special act was passed August 5, 1886:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled: That it shall be the duty of the Attorney-General of the United States to institute, as soon as may be, in the supreme court of the District of Columbia, a suit against all persons and corporations who may have or pretend to have any right, title, claim, or interest in any part of the land or water in the District of Columbia within the limits of the city of Washington, or exterior to said limits and in front thereof toward the channel of the Potomac River, and composing any part of the land or water affected by the improvements of the Potomac River or its flats in charge of the Secretary of War, for the purpose of establishing and making clear the right of the United States thereto.

SEC. 2. That the suit mentioned in the preceding section shall be in the nature of a bill in equity, and there shall be made parties defendant thereto all persons and corporations known to set up or assert any claim or right to or in the land or water in the said first section mentioned, and against all other persons and corporations who may claim to have any such right, title, or interest. On the filing of said bill process shall issue and be served, according to the ordinary course of said court, upon all persons and corporations within the jurisdiction of said court; and public notice shall be given, by advertisement in two newspapers published in the city of Washington, for three weeks successively, of the pendency of said suit, and citing all persons and corporations interested in the subject-matter of said suit, or in the land or water in this act mentioned, to appear, at a day named in said notice, in said court, to answer the said bill and set forth and maintain any right, title, interest, or claim that any person or corporation may have in the premises; and the court may order such further notice as it shall think fit to any party in interest.

SEC. 3. That the said cause shall then proceed with all practicable expedition to a final determination by said court of all rights drawn in question therein; and the said court shall have full power and jurisdiction by its decree to determine every question of right, title, interest, or claim arising in the premises, and to vacate, annul, set aside, or confirm any claim of any character arising or set forth in the premises; and its decree shall be final and conclusive upon all persons and corporations parties to the suit, or who shall fail, after public notice as hereinbefore in this act provided, to appear in said court and litigate his, her, or its claim, and they shall be deemed forever debarred from setting up or maintaining any right, title, interest, or claim in the premises.

SEC. 4. That if, on the final hearing of said cause, the said supreme court of the District of Columbia shall be of opinion that there exists any right, title, or interest in the land or water in this act mentioned in any person or corporation adverse to the complete and paramount right of the United States, the said court shall forthwith and in a summary way proceed to ascertain the value of any such right, title, interest, or claim, exclusive of the value of any improvement to the property covered by such right, title, or interest, made by or under the authority of the United States, and report thereof shall be made to Congress.

SEC. 5. That from the final decree of the supreme court of the District of Columbia, and every part thereof, in the premises, an appeal shall be allowed to the United States, and to any other party in the cause complaining of such decree, to the Supreme Court of the United States, which last-mentioned court shall have full power and jurisdiction to hear, try, and determine the said matter, and every part thereof, and to make final decree in the premises; and the said cause shall, on motion of the Attorney-General of the United States, be advanced to the earliest practicable hearing: *Provided*, That no payment under any such judgment shall be made unless hereafter authorized by Congress.

SEC. 6. That until the final decision of the matters hereinbefore in this act mentioned shall have been had, no moneys appropriated for the improvement of the Potomac River within the District of Columbia, the establishment of harbor lines in the District of Columbia, and the raising of the flats therein, shall be expended otherwise than upon property in respect of which there is no claim adverse to the title of the United States or for the improvement of navigation in the said river.

In accordance with the provisions of this act a bill of complaint and answers was filed November 26, 1886, in the supreme court of the District of Columbia, holding a special term in equity.

Since the date of the passage of the above bill the work of reclamation and filling has been confined to that portion of the flats below the limits of the marsh known as "Kidwell's Meadows," and as there are numerous claimants to portions of the land abutting upon the Washington Channel of the Potomac River, the establishment of harbor lines in that channel has been left in abeyance.

It is now the eighth year since the passage of the special act of August 5, 1886, and beyond the taking of testimony no progress appears to have been made with this suit. As the work of filling is now nearing completion, it is earnestly recommended that the proper steps be taken to bring this suit to an issue, as otherwise a point will soon be reached where this important work of improvement must be suspended.

In the annual report of the Attorney-General of the United States for 1893, under the head of "Potomac Flats Litigation," he states as follows:

> This litigation relates to a suit in the nature of a bill in equity, brought under a special statute, to determine the title to a tract of land in the District known as the Potomac Flats. The United States attorney for the District reports that the taking of evidence on behalf of all parties has closed, so that the case is ripe for hearing. A serious question has arisen, however, whether jurisdiction over the suit is still in the supreme court of the District of Columbia or has been transferred to the court of appeals for the District by force of the act of February 9, 1893, providing for the establishment of that court. The attorney suggests that the question be settled by appropriate legislation—a mode of settlement which will clearly save much time and expense, and which I have, therefore, no hesitation in approving.

WORK DONE AND RESULTS OBTAINED.

At the close of the fiscal year ending June 30, 1893, the expenditures aggregated $1,843,165.85, and the following work had been accomplished: The Virginia Channel above Long bridge had been deepened to 20 feet at low tide for a width of from 400 to 550 feet. As a result of successive freshets, however, and notably that of 1889, the dredged channel has filled up and the bar partly reformed, so that it has several times been necessary to redredge this channel. In order to contract the waterway and prevent the re-formation of the bar, a training dike has been projected, commencing at the lower end of Analostan Island, and extending downstream on the right of the channel. This dike is partly an earthen embankment and partly built of riprap stone; 4.900 linear feet of dike had been completed.

Below the Long bridge the Virginia Channel had been widened on the left side and deepened to 20 feet. The increase in width just below the bridge is 500 feet, gradually diminishing to a point 3,000 feet below the bridge, where the natural channel has not yet been widened. The lower bar in the same channel below Long bridge and near Giesboro Point had been dredged to a depth of 20 feet and a width of about 350 feet. This channel has not only maintained itself to the full depth originally dredged, but has deepened. The Washington Channel had been dredged to a depth of 20 feet for a width of 350 feet throughout its entire length and to a depth of 12 feet from the 20-foot channel nearly to the easterly margin of the fill, except a small area near the Seventh street wharf. This channel, for the most part, maintained itself until the freshet of June, 1889, when considerable filling took place.

The junction of the Virginia and Washington channels had been dredged to depths of 20 feet, 15 feet, and 12 feet. The greater part of the tidal reservoir had been dredged to a depth of 8 feet. All the material dredged from the river has been deposited on the flats. The material dredged from the Virginia Channel above the Long bridge has been deposited on Sections I and II; that dredged from the Tidal Reservoir has been deposited on Section II, and that dredged from the Virginia Channel below the Long bridge and from the Washington Channel has been deposited on Section III. On June 30, 1893, 9,465,200 cubic yards of material had been deposited on the flats. Of this amount over 5,000,000 cubic yards have been dredged and deposited at one operation by hydraulic dredges, a method which has contributed greatly to the economy of the work. Practically the entire area to be reclaimed, about 621 acres, has been raised to a height of 6 feet or more above low tide, while much of it is from 10 to 12 feet above.

In order to retain the material deposited on the flats and protect it from erosion by waves and the action of currents, the project provided for the construction of a sea wall around the exterior margin of the reclaimed area and the margin of the Tidal Reservoir. This wall is built on a riprap foundation 6 feet deep, laid in a trench previously dredged. The wall is built of dry rubble masonry. The base of the wall is at the level of low tide, and the wall is 6 feet high. The face has a batter of 4 inches to the foot, and the average thickness is 3 feet 6 inches. On June 30, 1893, the riprap foundation had been put in around the entire river front and Tidal Reservoir, and 18,290 linear feet of wall built. The outlet gates of the Tidal Reservoir at the head of the Washington Channel had been completed with the exception of the railing.

The details of these various operations have been given in previous annual reports (1883-'93).

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

The work of the fiscal year ending June 30, 1894, has been done under the appropriation of $200,000 made July 13, 1892.

Sea wall.—On June 30, 1893, the construction of the sea wall was in progress on the Virginia Channel front of Section III. This work was continued and fair progress was made in July and August, 1893, although during the entire season delays were experienced from the unusually high tides which prevailed. On the night of August 28, 1893, a severe wind and rain storm swept over the city, and the tide rose to a height of more than 6 feet, passing over the top of the wall. Some damage was done by logs and scows which drifted against it.

During September, 1893, about one-fourth of the time was lost from bad weather and only 800 linear feet of wall were built. On October 13, 1893, there was a severe storm, accompanied by northeast to southwest winds, which caused the tide to rise to a height of 8.8 feet above low tide, overflowing the wall and portions of the reclaimed land. The tool scow anchored in front of the wall dragged its anchor and was carried ashore on Section III. The wall above Long bridge was slightly injured by a sand dredge, which also went adrift.

Nine hundred linear feet of wall were completed during October, and in November, 1893, the wall on the Virginia Channel front of Section III was completed up to the Long bridge. Work was then resumed on the Washington Channel front and continued during the winter. The winter of 1893–'94 proved to be unusually mild and it was found practicable to continue this work without serious interruption until February 28, 1894, when the wall on the Washington Channel front was completed up to the Long bridge. The amount of wall built during the fiscal year was 7,205 linear feet, making a total of 25,495 feet. The work was done by hired labor and the purchase of material in open market.

In order to protect the wall from frost and prevent the filling behind it from being washed out and drawn through the joints of the dry masonry by the action of waves and the swell of passing steamers, a backing of coarse gravel about 2 feet in thickness is placed behind it. A contract was entered into with Mr. George J. Simpson, of Philadelphia, Pa., September 22, 1892, for supplying this gravel at 46 cents per cubic yard. The contractor, however, failed to deliver any gravel, and purchase has since been made in open market at his expense, as provided in the specifications, at 60 cents per cubic yard.

Two thousand five hundred and seventy-seven and one-tenth cubic yards have been so purchased up to June 30, 1894. During the winter of 1893–'94 it was impracticable to obtain gravel, and oyster shells were purchased instead, and proved to be entirely satisfactory as a substitute.

Dredging in Washington Channel.—On June 30, 1893, dredging in the Washington Channel was in progress under the contract of the San Francisco Bridge Company, dated September 24, 1892. This contract provided for dredging in the Washington and Virginia channels and the Tidal Reservoir and depositing the material dredged on the reclaimed area at the uniform price of 14 cents per cubic yard. On June 1, 1893, dredging to the depth of 12 feet of the anchorage ground between the navigation channels and the wall was commenced, this work being that left unfinished by the Alabama Dredging and Jetty Company, when their contract was annulled. On June 30, 1893, 27,693 cubic yards had been dredged under the contract. An hydraulic dredge of the Von Schmidt pattern was employed on this part of the work, but as it was not in thorough repair, rather slow progress was made. The 12-foot dredging was practically completed September 25, 1893, 92,696 cubic yards having then been dredged under the contract. On October 20, 1893, dredging in the navigation channel was commenced with the hydraulic dredge *Boston*, off the foot of N street SW., the dredge working downstream. This dredge swings upon a stern spud as a pivot, and will make a cut 150 feet wide. In the Washington Channel the cuts were about 133 feet wide. The suction pipe and cutting apparatus are secured to an inclined boom called a ladder, which is submerged and raised or lowered, according to the amount of cutting and the depth to be made. The cutter is operated by an independent engine secured to the upper end of the ladder. The pump is a centrifugal pump 5 feet in diameter, connected with the engine by a belt. The dredge is swung to the right or left by means of two wire cables attached to anchors, one on either side, the cables being alternately wound and unwound on a drum. The discharge pipe passes out at the stern of the dredge and is carried to the shore on pontons, as is the case with other hydraulic dredges. The dredge worked continuously for twenty-four hours, was well manned and kept in constant repair, and has proved the most efficient dredge ever employed on this work.

In order to avoid any delay or inconvenience to vessels or steamers using the channel, the easterly cut along the wharves was made at night, leaving this part of the channel open for navigation during the day. The dredge continued to work downstream, dredging the full width of 400 feet in 3 cuts until in December, 1893, the lower limit of the work to be done under this contract, near the upper end of the Arsenal grounds, was reached. It was then taken back to the starting point and worked upstream to the upper limit of the navigation channel, off Riggs Wharf, at the foot of Thirteen-and-a-half street, which was reached March 8, 1894.

The navigation channel was dredged under this contract to a depth of 20 feet at low tide from the turn in the channel near the upper end of the U. S. Arsenal grounds to the foot of Thirteen-and-a-half street, just below the Long bridge, a distance of 6,297 feet. The width of the dredged channel is 400 feet, except for a length of 160 feet at the upper end, where it was gradually diminished to 300 feet, and for a length of 600 feet at the lower end, where it connects with the unfinished channel below. The navigation channel was formerly 350 feet wide. The amount of dredging from the Washington Channel was 497,327 cubic yards, of which it is estimated that about 275,000 cubic yards was redredging of material brought into the channel by the freshet of 1889. The material was almost entirely soft mud, and was deposited on Section III, suitable embankments for confining the material and draining off the water having been built by the contractors. In order to deposit the material approximately to the required grade of 12 feet at the center of the section, and 6 feet at the sea wall, two longitudinal embankments were thrown up between the center line and the wall, forming with cross embankments 3 basins. Even with these precautions it has not been found practicable with the hydraulic method to secure so slight a fall as 1 in 150, the material usually assuming a much flatter slope.

Dredging in the Tidal Reservoir.—The dredge was next removed to the Tidal Reservoir, and on March 12, 1894, commenced dredging a part of the reservoir at the southwest corner, which had not previously been dredged. The depth made was 8 feet at low tide, as required by the project. The material found here was mud, with a considerable admixture of sand. It was deposited on that part of Section II lying between the Tidal Reservoir and the Long bridge. This work was continued until April 23, 1894, when the dredging to be done at this locality under this contract was completed. The amount of material dredged in the Tidal Reservoir was 168,611 cubic yards. Of the above period about one week was spent in repairs, the pump having become much worn by sand. The number of engine hours was 601, giving an average work of 285 cubic yards per engine hour, the best average work of any hydraulic dredge heretofore employed on this work.

Dredging in the Virginia Channel.—A preliminary examination of the channel dredged through the upper bar in 1892 was made in April, 1894. It was found that a shoaling of from 2 to 3 feet had taken place as the result of ordinary freshets during the intervening period, so that the ruling depth had been reduced to 17½ feet. It therefore became necessary to redredge a part of this channel, as provided in the contract, as well as to widen it on the westerly side. This work was commenced April 24, 1894. Operations were interrupted by two freshets, one on May 8 and the other on May 21, 1894. The former interrupted the work but for one day. It rose only to a height of about 5 feet, but was remarkable for the excessive amount of sediment which the water carried. This is attributed to the fact that the rains causing the freshet fell comparatively near Washington and on recently plowed fields. This freshet caused a shoaling of more than 1 foot, both over the dredged and parts of the undredged channel, reducing the ruling depth in the former to about 19.5 feet. The deposit was very soft, however. The following freshet of May 21 rose to a height of 6.5 feet and delayed the work for a week. The water came from the upper part of the valley and carried less sediment. The current was very strong, however, and much of the deposit of May 8 was carried away, thus restoring the standard depth of 20 feet in the dredged channel.

Dredging operations were resumed May 28, 1894, and on June 30, 1894, were still in progress. At the last-named date 4,600 linear feet of this channel had been dredged to a width of 230 feet and a depth of 20 feet, the amount of dredging being 146,004 cubic yards, making a total under the contract of 811,942 cubic yards.

Training Dike.—On September 22, 1892, a contract was entered into with George J. Simpson, of Philadelphia, Pa., for the delivery of riprap stone for the continuation of work on the Training Dike on the west side of the Virginia Channel above the Long bridge. The contractor failed to commence the delivery of the stone, and after due notice it was purchased in open market at his expense as required by the specifications. The contract price is 72 cents per cubic yard. During the fiscal year ending June 30, 1893, 7,280.4 cubic yards were purchased at 90 cents per cubic yard, and during the fiscal year ending June 30, 1894, 2,922.1 cubic yards were purchased at the same price, a total of 10,202.5 cubic yards, all of which was used in raising the dike to the height of 6 feet above low tide to insure more efficient action during ordinary freshets.

Clearing.—The rich and fertile soil of which the reclaimed area is composed has induced a rapid and dense growth of vegetation. In the summer a large variety of weeds spring up and rapidly attain a height of 6 or 8 feet, while the willow, not heretofore indigenous to this part of the river, has grown from seed dormant in the alluvial deposits which have been dredged from the river, covering several hundred acres. This dense growth has been a source of much difficulty in carrying on the various operations of the improvement, and during the past fiscal year a considerable part of the reclaimed area has been cleared up, chiefly where material was to be deposited under the contract for dredging.

Maintenance.—The improvement has now reached a stage where some attention needs to be given the maintenance and preservation of the reservation. The growth of weeds, willows, and other trees and underbrush, which, in the summer season especially, render access to the various parts of the work quite difficult, should be cleared up each year, until the reservation is ready to be laid out, graded, and sown with grass seed. Annual repairs will also be needed on the wall and reservoir gates.

The proper police supervision of this extensive area of 621 acres has also become a matter of importance. In order to prevent infractions of the law, trespasses, etc., the reservation should be patrolled by mounted police or watchmen, and it is recommended that annual provision be made for two watchmen. It is estimated that $5,000 will be required per annum for maintenance.

LONG BRIDGE.

At the date of the inception of the Potomac River improvement (1882) the Long bridge consisted of three parts, viz: Commencing at the Washington shore, (1) a bridge across the Washington Channel of wooden spans on masonry piers and about 700 feet in length; (2) a causeway of earth between masonry retaining walls across the flats between the two channels and about 1,980 feet in length, and (3) a bridge across the Virginia Channel about 2,000 feet in length.

The Long bridge across the Virginia Channel is a wooden Howe truss bridge consisting of 13 spans of 135 feet each in the clear and one draw span 182 feet in length swinging on a pivot pier giving two openings of about 70 feet, only one of which is arranged for the passage of vessels. Each span except the draw consists of three wooden trusses. The extreme widths of the bridge from out to out of trusses is 40.4 feet. On the upstream, or northwest side is a wagon road 19.2 feet wide in the clear, but with no sidewalk, while on the downstream side is the single track of the Baltimore and Potomac Railroad, with a clear width between trusses of 13.2 feet. The bridge spans rest upon masonry piers built of an inferior quality of sandstone and founded upon pile and grillage foundations, the grillage being at the level of low tide. In order to prevent these insecure foundations from being undermined by the river currents, large quantities of riprap stone have been thrown into the river and piled about them until there is now a series of immense mounds extending across the river channel. So great is this obstruction that the natural discharge area of the river at the Long bridge is reduced no less than 30 per cent by these pier foundations and the riprap stone deposited about them.

The direction of the bridge is not normal to the direction of the proposed, the present, nor even the original channel, so that the piers (being built at right angles to the line of the bridge) are not parallel to the direction of the current, but are oblique to it, and so become themselves a serious obstruction during freshets.

A further obstruction arises during freshets from the height of the existing bridge. The lower chord is but 10.3 feet in the clear above low tide, while the floor is but 13 feet above low tide.

The freshet of 1889 rose to a height of 12.7 feet above low tide at the Long bridge, and thus the superstructure of the bridge diminished the maximum freshet cross section by a depth of no less than 2.4 feet, or about one-fifth of the height which the water rose above low tide.

The cross section of the river at the Long bridge for freshet discharge has been greatly diminished by reason of the closing of the Washington Channel as a necessary part of the plan of improvement. This diminishes the available freshet cross section at the bridge by about 22 per cent, based upon the freshet cross section of 1877. The height as well as the discharge cross section of the freshet of 1889, however, were much greater than that of 1877, and the area required for the discharge of such a freshet would be much greater than was estimated when the plans for the improvement were originally prepared.

The draw of the existing bridge is badly located, having been placed near the easterly edge of the navigation channel. Although this channel has since been widened by dredging, the draw opening is oblique to the general direction of the channel and the current, and the opening is therefore a difficult one for vessels to pass, and so interferes with the safe navigation of the river.

The project for the improvement of the Potomac River provided for rebuilding the Long bridge over the Virginia Channel, "with wide spans upon piers offering the least possible resistance to the flow of water." As the improvement progresses the necessity for this becomes more and more urgent.

Long bridge, on account of its faulty construction, remains a constant menace to the interests on the river front above it, and also to the work of improvement of the flats, upon which the Government has already spent a large sum. In the event of a freshet occuring while the river is full of ice, the most serious results are to be apprehended, and such a contingency is not at all unlikely. Should an ice gorge form at Long bridge, it would back up the waters of the river and overflow portions of the city front, and, through the sewers above the bridge, such of the lower parts of the city as are drained by them.

During the freshet of June, 1889, the water reached (as above stated) a height at Long bridge of about 13 feet above low tide. The street surface at Fourteenth and B streets NW. is about 8 feet above low tide, and during the freshet referred to the water was about 5 feet deep in the street at that locality. Great damage was done by the freshet of 1889, but greater damage may occur from a freshet of lesser magnitude if accompanied by an ice gorge. The bridge should be rebuilt as recommended by the board of engineers.

The Baltimore and Potomac Railroad Company was authorized to take possession of the Long bridge by an act of Congress approved June 21, 1870, which in part provides as follows:

> *Provided*, That the said Baltimore and Potomac Railroad Company will maintain in good condition the said bridge for railway and ordinary travel; and the bridge shall at all times be, and remain, a free bridge for public use for ordinary travel.
>
> * * * * * * *
>
> That if the said Baltimore and Potomac Railroad Company shall at any time neglect to keep said bridge in good repair and free for public use for ordinary travel, the Government of the United States may enter into possession of the said bridge; and Congress reserves the right to alter or amend this law.

On April 5, 1890, a plan was submitted to Congress providing for the separation of the roadway and the railroad across the Washington Channel and the reclaimed area, elevating the tracks of the railroad across the reclaimed area high enough to give passageway for vehicles under them, and the reconstruction of the Long bridge over the Virginia Channel with long spans of about 270 feet each, with a pivot draw in the deep water of the channel. The piers were to be of first-class masonry, extending down to the bed of the enlarged cross section of the river so as to provide the least possible obstruction to the flow of water. The bridge was to be arranged for a roadway, sidewalk, and double-track railroad on the same grade. The floor was to be 24 feet above low tide, so the superstructure would not obstruct the flow of freshets, and so that tugs and scows might pass under the spans without making use of the draw.

In 1891-'92 the Baltimore and Potomac Railroad Company reconstructed that part of the Long bridge across the Washington Channel on plans approved by the Secretary of War. The greater part of the old channel was filled with earth, and two plate girder spans resting on two abutments and a center pier were built across the waterway of the Reservoir Outlet. The approaches were earthen embankments, but on filling these approaches a decided settlement and movement of the abutments was developed. The movement in the south abutment was so serious that the abutment was taken down to the water level and rebuilt. In order to prevent further movement, a large number of piles were driven in the bed of the river between the pier and the abutments, and a temporary trestle to support one end of the south span was built. The connection between the wing walls of the new bridge and those of the Reservoir Outlet has not yet been made by the railroad company. No additional work has been done here by the railroad company during the fiscal year ending June 30, 1894.

On December 20, 1892, a special report was made upon the reconstruction of the Long bridge, in which appropriate legislation looking to this object was recommended. (Report of Chief of Engineers 1893, pp. 1274–1280.)

Future operations.—The items of work remaining to be completed are as follows: The completion of the dredging of the Washington Channel; the removal of freshet deposits in the Tidal Reservoir and the construction of the sea wall; the construction of the inlet tide gates, which will prevent freshet waters from passing into the Tidal Reservoir and down the Washington Channel; the dredging of the Virginia Channel above and below the Long bridge to improve the navigation and to facilitate the discharge of freshets; the completion of the training dike above Long bridge.

APPROPRIATIONS.

Appropriations have been made as follows:

August 2, 1882	$400,000
July 5, 1884	500,000
August 5, 1886	375,000
August 11, 1888	300,000
September 19, 1890	260,000
July 13, 1892	200,000
Total	2,035,000

Washington is in the collection district of Georgetown, D. C. The nearest lighthouse is at Jones Point, Virginia.

*Money statement.**

July 1, 1893, balance unexpended		$191,834.15
June 30, 1894, amount expended during fiscal year		140,301.83
July 1, 1894, balance unexpended		51,532.32
July 1, 1894, outstanding liabilities	$666.00	
July 1, 1894, amount covered by uncompleted contracts	19,122.00	
		19,788.00
July 1, 1894, balance available		31,744.32
Amount (estimated) required for completion of existing project		681,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		681,365.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

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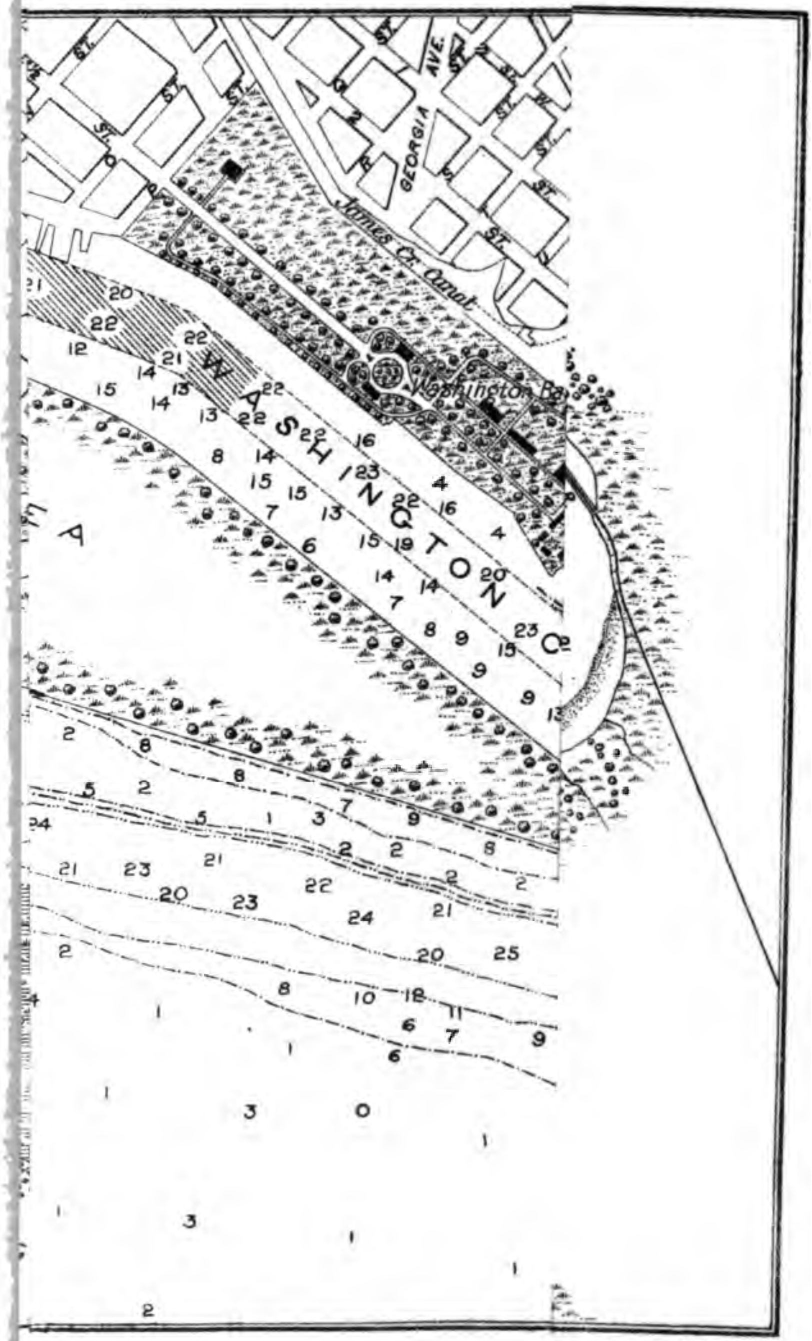
* In the Annual Report for 1893 the balance available for Eastern Branch of the Potomac River was included in this statement.



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UNIV. OF MICH.

COMMERCIAL STATISTICS.

[Furnished by Mr. J. W. Averill, Washington, D. C.]

Receipts and shipments.

Calendar year—	Coal.	Ice.	Lumber.	Sand.	Wood.	Miscellaneous.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1887	264, 947	120, 237	37, 044	50, 000	52, 419	94, 325	618, 972
1888	240, 836	108, 421	45, 101	50, 000	33, 040	104, 177	581, 575
1889	92, 511	115, 506	41, 407	75, 000	35, 351	128, 905	488, 680
1890	72, 089	135, 552	69, 604	75, 000	48, 457	118, 994	519, 696
1891	114, 913	123, 107	50, 166	60, 000	48, 457	154, 636	551, 219
1892	280, 342	148, 692	68, 178	20, 000	48, 457	261, 285	766, 954
1893	333, 837	143, 837	33, 167	18, 000	48, 457	76, 135	653, 433

In addition to the foregoing it is estimated that 107,579 tons of miscellaneous freight was received and shipped by the Norfolk and river steamers during the year.

Number of vessels of various classes arriving and departing.

Calendar year—	Steamers drawing from 5 to 15 feet, 100 to 400 tons.	Vessels drawing from 10 to 20 feet, 300 to 1,700 tons.	Vessels drawing from 4 to 10 feet, 30 to 300 tons.	Barges drawing from 4 to 10 feet, 100 to 300 tons.
1887	970	573	2, 149	993
1888	710	525	1, 588	2, 821
1889	675	455	1, 563	923
1890	696	491	1, 572	286
1891	980	445	1, 854	862
1892	1, 065	466	2, 046	527
1893	906	431	2, 301	450

Ferry and local passenger steamers are not included in the above. No new lines of transportation were established during 1893.

J 2.

IMPROVEMENT OF ANACOSTIA RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

GENERAL DESCRIPTION AND ORIGINAL CONDITION.

The Anacostia River, formerly known as the Eastern Branch of the Potomac River, enters the Potomac between Greenleaf and Giesboro points and forms the southeast boundary of the city of Washington. The river rises in Maryland and the head of tide water is at Bladensburg, Md., where the width is 135 feet and the range of tides 2.1 feet. In 1835 Bladensburg was the head of navigation for vessels of 60 tons burden, but for 2 miles below, or down to the boundary line of the District of Columbia, the channel is filled with bars of sand and other freshet débris so that scarcely more than 1 foot can be carried up to the town. At the District line the width is 200 feet gradually increasing to 700 feet at Bennings bridge, 2 miles below, while the ruling depth is 3 feet for half a mile increasing to about 5 feet. This part of the river is a source of supply for building sand and the depths on the bars vary constantly from sand-dredging. Below Bennings bridge the river suddenly expands in width to 3,000 feet resulting in the formation of wide flats or marshes covered with a rank growth of sedges, wild rice, and other aquatic plants. The flats occur first on the right and then on the left of the channel which follows a devious course through them for 1½ miles to the Baltimore and Potomac Railroad bridge, the ruling depth being about 6 feet. Neither of these two bridges has a draw. From the Baltimore and Potomac Railroad bridge to the Navy-Yard bridge, 1¼ miles below, the river is about 1,200 feet wide, the channel—following the left bank—being from 100 to 200 feet wide with a ruling depth of 12 feet. The flats on the left of the channel have a depth of from 1 to 2½ feet. The Pennsylvania avenue bridge crosses the river about 4,000 feet above the Navy-Yard bridge. It has no draw. The Navy-Yard bridge has a draw, however, 33 feet wide. From the Navy-Yard bridge to the mouth of the river, a distance of about 2 miles, the channel, still following the right bank, is exceedingly crooked and narrow and is difficult of navigation by vessels of even moderate length. Navigation was further obstructed by 3 bars over which but from 18 to 19 feet could be carried. The width of this part of the river ranges from 1,800 feet, at the Navy-Yard bridge, to about 4,500 feet at the mouth at Greenleaf Point. On the left or southeast side of the channel are wide flats having a depth of from 1 to 4 feet at low tide, covered in summer with a growth of water grass, which are gradually shoaling and becoming a source of malaria.

The Washington navy-yard has a fine water frontage of nearly 1,300 feet, but the channel in front of it is only 300 feet wide and so shallow that the smaller vessels of the new Navy can be turned only with great difficulty. At this navy-yard has been established the excellent gun shop of the Navy Department for the fabrication of modern guns, so that the yard has a growing importance as a naval establishment. The importance of improving the channel and rendering the yard accessible to at least some of the vessels of the Navy can hardly be overestimated.

Between the navy-yard and the U. S. arsenal is a valuable water front 6,500 feet in length, which is readily susceptible of improvement and which would then afford great relief to the Washington Channel, as well as increased business facilities to the southeastern section of the city. At present there are a few wharves used for the trade in ice, wood, asphalt, etc.

PLAN OF IMPROVEMENT.

A survey of the Anacostia River was made in accordance with the provisions of the river and harbor act of September 19, 1890, and a report upon the same with a plan for the improvement of so much of the river as lies between the mouth and the Navy-Yard bridge, was transmitted to Congress December 8, 1891. (Fifty-second Congress, first session, Ex. Doc. No. 30.) The plan of improvement provides for dredging a channel with improved alignment from the mouth to the Navy-Yard bridge, 1,000 feet in width, having a maximum depth of 24 feet in the navigation channel 200 feet wide, the depth gradually diminishing toward the bulkhead lines on either side of 12 and then to 6 feet. In front of the navy-yard a basin is proposed 400 feet wide and 24 feet deep. The material dredged from the channel was to be placed on the flats, this being the most economical and advantageous method of disposing of it. At the same time this would reclaim these flats and improve the sanitary condition of the southeast section of the city.

The estimated cost of the improvement proposed was $656,000.

WORK DONE AND RESULTS OBTAINED.

An appropriation of $20,000 was made for the improvement of this river September 19, 1890, which was applied to dredging channels 20 feet deep and about 200 feet wide through shoals near the foot of South Capitol street and off Greenleaf or Arsenal Point. This work was completed in May, 1892, and fully described in the Annual Report for that year.

In accordance with the above project, bulkhead and wharf lines have been established and will be found described in the Report of the Chief of Engineers for 1892, pp. 1080-1083.

About $10,000 have been expended by the Navy Department in dredging a basin in front of the navy-yard 22 feet deep and from 100 to 200 feet wide, the work having been completed in October, 1892.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

No work has been done during the fiscal year ending June 30, 1894, as no funds for this purpose were available.

FUTURE OPERATIONS.

The work already done has afforded only temporary relief in the channel, and the interests of the United States at the Washington navy-yard create an urgent necessity for the active prosecution of this improvement. It is recommended that an appropriation of $100,000 be made for this object.

APPROPRIATION.

The following appropriation has been made:

September 19, 1890	$20,000

Anacostia River is in the collection district of Georgetown, D. C. The nearest light-house is Jones Point, Virginia.

*Money statement.**

July 1, 1893, balance unexpended	$1,878.06
June 30, 1894, amount unexpended during fiscal year	105.00
July 1, 1894, balance unexpended	1,773.06
Amount (estimated) required for completion of existing project	636,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

J 3.

IMPROVEMENT OF OCCOQUAN CREEK, VIRGINIA.

ORIGINAL CONDITION.

Occoquan Creek is a tributary of the Potomac River, which it enters about 25 miles below Washington, D. C. The stream is navigable from its mouth at Sandy Point to the town of Occoquan, a distance of 4 miles. Navigation was obstructed by four bars, which were improved between 1873 and 1880 by dredging and dike construction so as to secure a navigable depth of about 6 feet at low tide. Four appropriations were made from 1873 to 1878, amounting to $25,000, and in 1880 the improvement was regarded as completed.

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*In the Annual Report for 1893, the balance available for this improvement was included in the statement for Potomac River.

In compliance with the provisions of the river and harbor act of August 11, 1888, a new survey of the creek was made in 1889. The condition of the several bars at that date was as follows:

Lower Mud (about 3.5 miles below Occoquan).—This bar had a least depth of about 3 feet and a length of about 4,000 feet. The former dredged channel was found to have filled in.

Upper Mud (about 2.25 miles below Occoquan).—This bar is about 2,000 feet long. The channel dredged in 1874–'75 was found to have maintained its original dimensions, the width being about 50 feet and the depth from 5 to 6 feet.

Sand Bar (about half a mile below Occoquan).—The channel formerly dredged here had filled in, the least depth being 4.2 feet.

Occoquan Bar (a sand bar opposite Occoquan).—This is a short bar with a least depth of 4 feet, the dredged channel having filled in.

PLAN OF IMPROVEMENT.

The depth desired for navigation was 6 feet at low tide. It was proposed in the report upon the survey to secure this depth by dredging channels 8 feet deep and from 100 to 150 feet wide, and by the construction of dikes, at an estimated cost of $91,250. (Report of the Chief of Engineers, 1890, pp. 1089-1096.) On September 19, 1890, an appropriation of $10,000 was made for the new improvement, for which the following project was approved December 5, 1890:

Lower Mud.—A channel 6 feet deep to be dredged, the "upper section" for about 2,500 feet below Taylors Point to be 100 feet wide, the material to be deposited on the west side of the channel, and the remainder of channel, or "lower section," to be 150 feet wide, the material to be removed in scows.

Upper Mud.—A channel 100 feet wide and 6 feet deep to be dredged, the material to be deposited on the east side of the channel, and the embankment so formed connected with the left bank by a dike.

Sand Bar.—A channel 100 feet wide and 6 feet deep to be dredged, and sheet-pile dikes constructed to maintain the dredged channel.

Occoquan Bar.—A channel 100 feet wide and 6 feet deep to be dredged, and a dike to be constructed to maintain the depth.

The estimated cost of this project was $45,000.

WORK DONE AND RESULTS OBTAINED.

Under the appropriation of $10,000 made September 19, 1890, a channel was dredged through the Lower Mud 6 feet deep at low tide. The lower or outer section of this channel, 870 feet in length, was dredged to a width of 150 feet to counteract the deteriorating action of cross-tidal currents. The upper section, 3,720 feet in length, was dredged to a width of 100 feet. The material from the lower section was removed in scows, while that from the upper section was deposited on the right side of the channel, so as to form an embankment.

The available balance of the appropriation remaining after the completion of the channel at the Lower Mud was applied to dredging a part of the channel through Occoquan Bar, which was next in order as an obstruction to navigation. This channel was made 8 feet deep, to provide for anticipated filling from freshets before the construction of the dike. The upper section of this channel was dredged to a width of 100 feet, and the lower section to a width of 70 feet, when, all the available funds having been exhausted, the work was closed.

The second appropriation under the new project was made July 13, 1892, the amount being $5,000. With this appropriation the construction of dike at Occoquan Bar and dredging at three of the bars were undertaken. The dike at Occoquan Bar was constructed by contract. It is built of riprap stone. The top is 4 feet wide and 3 feet above low tide, and the side slopes are 1 on 1. One thousand six hundred and twenty-one cubic yards of stone were put in place, 622 linear feet of dike were entirely completed, and 161 linear feet partly completed. The work of the contractor was interrupted by an injunction obtained by a riparian owner from a State court of Virginia, and the contract was closed. (Report of the Chief of Engineers for 1893, pp. 1283–1284.) The dike remains unfinished, much to the detriment of the work.

The dredging was done by contract with D. McConville, of Washington, D. C. On June 30, 1893, the following work had been done under the contract: At Occoquan Bar 2,275 cubic yards had been dredged, which, together with 12,399 cubic yards dredged under a previous contract, made the total dredging at Occoquan Bar 14,674 cubic yards, by which a channel 100 feet wide and 8 feet deep had been secured.

At the Sand Bar, one-half of a mile below Occoquan, 1,576 cubic yards were dredged and a channel 100 feet wide and 6 feet deep was secured.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

At the Upper Mud dredging was in progress at the close of the fiscal year ending June 30, 1893. Operations were continued at this bar, but, owing to the dilapidated condition of the endless-chain dredge which was in use, the progress was extremely slow and unsatisfactory. On July 5, 1893, the time for the completion of the contract was extended to September 1, 1893. July and August, 1893, were spent in repairs and futile attempts to run the dredge. Only 285 cubic yards were dredged during these two months. On August 24, 1893, the dredge sank in the channel. On August 30, 1893, the time for the completion of the contract was extended sixty days to October 31, 1893. Operations remained suspended until October 10, 1893, when a clam-shell dredge was placed on the work at the Upper Mud. On October 25, 1893, the time for the completion of the contract was again extended thirty days to November 30, 1893. The clam-shell dredge made satisfactory progress and work was continued until November 17, 1893, when the available funds were exhausted. Active operations under the appropriation of July 13, 1892, were then closed. The channel at the Upper Mud was deepened to 6 feet at low tide where the depth was insufficient and widened from 50 feet in width to 100 feet in width for a length of 1,350 feet, or somewhat more than one-half the length of the channel. Three groups of piles originally driven to mark the easterly line of the channel were, by reason of the widening on that side, brought within the limits of the 100-foot channel, and were therefore removed. A large building stone found at the upper end of the channel was also taken out.

The amount of dredging at the Upper Mud under the contract of D.

McConville was 8,867 cubic yards. The amounts of dredging at the three bars under this contract were as follows:

	Cubic yards.
Occoquan Bar	2,274.7
Sand Bar	1,575.7
Upper Mud	8,867.0
Total under contract	12,717.4

The time occupied in doing this work was over one year.

The sunken dredge remained in the Upper Mud channel until February 23, 1894, when it was raised. On March 4, 1894, it was towed away from the creek.

FUTURE OPERATIONS.

The work remaining to be done is the completion of the channel at the Upper Mud and the completion and the construction of the dikes at Occoquan Bar, the Sand Bar, and the Upper Mud. The estimated cost of the remaining work, based on the original estimate, is $30,000.

APPROPRIATIONS.

The following appropriations have been made for the new project:

September 19, 1890	$10,000
July 13, 1892	5,000
Total	15,000

Occoquan Creek is in the collection district of Alexandria, which is also the nearest port of entry. The nearest light-house is at Fort Washington, Md.

Money statement.

July 1, 1893, balance unexpended	$2,493.68
June 30, 1894, amount expended during fiscal year	1,926.98
July 1, 1894, balance unexpended	566.70
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896,	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics for this work, but it has been impossible to procure them.

J 4.

IMPROVEMENT OF AQUIA CREEK, VIRGINIA.

ORIGINAL CONDITION.

Aquia Creek is a tributary of the Potomac River, which it enters 41 miles below Washington, D. C. The stream is navigable to Wharton Landing, about 7.25 miles above the mouth. The upper part of the creek has a well-defined channel, with a width of from 60 to 200 feet, while the depth was originally from 2 to 17 feet. At a point called the "Narrows," about 4.5 miles above the mouth, the stream suddenly expands into a wide bay from 1,000 to 6,000 feet wide, forming a continuous shoal on which the depth ranged generally from 2 to 4 feet, increasing near the mouth to about 7 feet. About 3 miles above the mouth the creek is crossed by a trestle bridge of the Richmond, Fredericksburg and Potomac Railroad. The bridge is provided with a draw 28 feet wide.

Between 1872 and 1878 $10,000 was appropriated by Congress and expended in dredging a channel through shoal portions of the creek between Davis Point (about one-third of a mile below the railroad bridge) and Wharton Landing, the channel being from 40 to 50 feet wide and from 4 to 5 feet deep at low tide.

A new survey of the creek was authorized by the river and harbor act of August 11, 1888, and made in 1889. The channel formerly dredged was found to be about 40 feet wide and from 4 to 5 feet deep between the railroad bridge and the Narrows. Below the railroad bridge and in the upper part of the creek near Wharton Landing it had filled in. Dent Landing, about three-quarters of a mile below Wharton Landing, was regarded as the highest point to which navigation could be maintained except at great expense. The obstructions to navigation below Dent Landing were the long shoal of soft mud between the mouth and the Narrows, on which the depth ranged from 2 to 4 feet; a short bar at the mouth of Austen Creek, with a ruling depth of 4 feet, and a wreck at Coal Landing.

PLAN OF IMPROVEMENTS.

In the report on the survey (Report of the Chief of Engineers, 1890, pp. 1096–1103) it was proposed to dredge a channel 150 feet wide and 8 feet deep between the mouth and the Narrows, and a channel 80 feet wide and 8 feet deep through the bar at the mouth of Austen Creek. The estimated cost of the improvement was $101,278.

On September 19, 1890, Congress appropriated $10,000 for this work. Upon further examination of this creek in 1890 the character of its navigation and the amount of its trade did not seem to warrant so large an expenditure as was proposed in the report on the survey of 1889. Six-foot navigation was regarded as sufficient to give all the relief needed to navigation at the present time, leaving the subject of greater depth for future action, if trade were developed by this improvement.

The following project of the work was therefore adopted December 4, 1890: A channel 80 feet wide and 6 feet deep to be dredged between the mouth and the Narrows, at an estimated cost of $40,000; the material dredged below the railroad bridge to be removed in scows, and that above the bridge for the most part to be deposited on the sides of the channel. The proposed work above the Narrows was omitted.

WORK DONE AND RESULTS OBTAINED.

Under the appropriation of September 19, 1890, of $10,000, a channel 6 feet deep and 80 feet wide was dredged through the two shoals which had less depth between the mouth and the railroad bridge. The dredged channel was commenced near Thorny Point, about 1 mile above the mouth.

The total length of the channel from the 6-foot curve, near Thorny Point, to the railroad bridge is 12,280 feet. In this distance it was unnecessary to dredge for a length of 3,400 feet, as a depth of 6 feet was found. The channel is thus divided into two sections, the lower being 2,740 feet in length, and the upper, near the bridge, 6,140 feet in length. The material dredged was soft mud. It was removed in scows and deposited in the Potomac River off Brents Point. The total amount of dredging under the contract was 60,438 cubic yards. The contract price was 12½ cents per cubic yard.

This work completed the approved project of 1890 up to the draw of the railroad bridge.

An appropriation of $5,000 was made for continuing the improvement in the river and harbor act of July 13, 1892.

The work remaining to complete the project for this improvement was the dredging of the channel between the railroad bridge and the Narrows, a distance of about 6,500 feet. The draw through the railroad bridge is about 28 feet wide. This width is insufficient for the passage of the dredges now usually employed on river and harbor work. A dredge such as would be required for the proper and economical execution of the work above the bridge would be about 35 feet wide, and to permit the passage of such a dredge the draw should be widened to at least 40 feet.

A report upon this subject having been made, the Secretary of War ordered the Richmond, Fredericksburg, and Potomac Railroad Company to widen the draw to 40 feet, but subsequently revoked the order; so it became necessary to modify the plan of the work above the bridge and adapt it to the class of dredge which could be taken through the draw. The material above the bridge was for the most part to be deposited on the sides of the channel, so as to form an embankment. As this mud is exceedingly soft and liable to run into the channel, it was proposed that it be deposited so that the foot of the inner slope of the embankment should be not less than 20 feet from the edge of the 80-foot channel, and the first specifications for this work issued in 1891 were so prepared. To form such an embankment would require a clam-shell dredge provided with a very long boom, and such a boom can only be carried by a wide dredge. The distance from the edge of the channel to the foot of the slope was therefore reduced to 15 feet. A contract for the work was entered into March 27, 1893, with Frank C. Somers, of Camden, N. J., providing for two classes of dredging, the material between the railroad bridge and the first island above to be removed in scows, and above the first island to be deposited on the sides of the channel, the price for each class being 11 cents per cubic yard.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

The date of commencement in the above mentioned contract was July 15, 1893, but the dredge did not arrive at the work until August 26, 1893. The channel was laid out and dredging was commenced on August 30, 1893, at the first island above the railroad bridge on that part of the channel which was to have the dredged material deposited in embankment on both sides of the same. Upon trial it was found that the dredge sent by the contractor could not deposit the material far enough from the side of the channel to conform to the requirements of the specifications. The dredge was therefore stopped until a chute could be built on a suitable scow. In the meantime a cut was dredged from the channel to the dumping ground for scow work, which was on the right side of the creek just above the southwest end of the railroad bridge. This work lasted from September 4 to September 11, 1893.

On September 15, 1893, dredging was resumed, the chute which had been built being used to deposit the material at the required distance from the side of the channel.

On September 29, 1893, the section of channel between the railroad bridge and the first island above was commenced. The material from this section was removed in scows and deposited on the above-mentioned dumping ground. This lower section of the channel was completed on October 18, 1893, and work on the upper section was resumed October 21, 1893. Favorable progress was made and the work under the contract was completed November 24, 1893. Under this contract 1,570 linear feet of channel from the railroad bridge to the first island above were dredged to the full dimensions of 80 feet in width and 6 feet in depth, the material being removed in scows, and 2,253 linear feet of channel above the first island were dredged to the same dimensions, the material being deposited on the sides of the channel. The amounts of dredging were as follows:

	Cubic yards.
Removed in scows	8, 160
Deposited on the sides of the channel	20, 394
Total	28, 554

FUTURE OPERATIONS.

The work remaining to be done under the present project is the completion of the channel above the railroad bridge. Recent and more detailed surveys show the amounts of dredging to be less than originally estimated, while lower prices have been obtained on the several contracts than were assumed in the project. It is now estimated that the present project can be completed for $10,000.

APPROPRIATIONS.

The following appropriations have been made for the new work:

September 19, 1890	$10, 000
July 13, 1892	5, 000
Total	15, 000

Aquia Creek is in the collection district of Alexandria, which is the nearest port of entry. The nearest light-house is at Maryland Point, Maryland.

Money statement.

July 1, 1893, balance unexpended	$4, 985. 75
June 30, 1894, amount expended during fiscal year	3, 550. 98
July 1, 1894, balance unexpended	1, 434. 77
Amount (estimated) required for completion of existing project	25, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	15, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics for this work, but it has been impossible to procure them.

J 5.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

ORIGINAL CONDITION.

Nomini Creek is an important tributary of the Potomac River, which it enters about 82 miles below Washington, D. C. At the date of the survey preliminary to the inception of the improvement (1872) its navigation was obstructed by a bar of oyster shells and sand at its mouth, over which but 3 feet could be carried at low tide. The dangers and difficulties in passing the bar were still further increased by strong cross tidal currents just inside the mouth at White Point. After passing the bar a wide and navigable stream is found, in which 8 feet can be carried for about 4 miles to Nomini Ferry, while 5 feet can be carried for about 6 miles above the mouth.

PLAN OF IMPROVEMENT.

The original project, adopted in 1873, provided for dredging a channel through the bar 100 feet wide and 9 feet deep at low tide, with side slopes of 2 to 1, at an estimated cost of $20,000. The project was amended in 1879 by increasing the width to 150 feet, in order to meet the demands of increased trade. In 1885 the project was again modified so as to provide for a channel 200 feet wide and 9 feet deep, and also for dredging a training channel and the construction of training dikes. The total cost of this amended project was placed at $62,500. In 1888 this estimate was increased to $72,500, the channel having deteriorated during the suspension of work from 1883 to 1889. Owing to the position of the channel, exposed to north and northwest winds and to cross tidal currents, it is difficult to secure any permanent or satisfactory results. The deterioration of the channel outside White Point is believed to be largely due to material stirred up by northwest winds and carried into the channel by the ebb and flood currents of Currioman Bay. In order to maintain the channel and prevent this injurious action the project was modified in 1890 as follows: (1) The dredged channel to be 9 feet deep and 150 feet wide, this width being sufficient for navigation and more likely to hold its depth. (2) Two jetties to be constructed, one from White Point on the east and one from Cedar Island on the west of the dredged channel, to extend out into Nomini Bay parallel to the channel. (3) Dikes to be built inside White Point to check the cross currents, but the training channel to be omitted. It was estimated that this modified project could be completed at a total cost of $72,500, which was the amount of the revised estimate of 1888 for a 200-foot channel.

WORK DONE AND RESULTS OBTAINED.

From March 3, 1873, to August 2, 1882, seven appropriations were made, ranging from $2,000 to $10,000, and aggregating $32,500. These appropriations were applied to dredging a channel through the bar, which at the close of work in 1883 was 100 feet wide, 9 feet deep, and 4,400 feet long. Operations were then suspended until 1889, when an appropriation of $5,000, made August 11, 1888, was expended in widening and deepening the channel outside White Point, which had partly filled in during the cessation of work.

The river and harbor act of September 19, 1890, appropriated $5,000 for continuing the improvement. Under this appropriation dredging by contract, in accordance with the modified project, was commenced April 30, 1891, and completed June 19, 1891. Ten thousand nine hundred and twenty-seven cubic yards of material were removed from the channel at and outside White Point, the depth made being 9 feet at low tide and the width 150 feet outside White Point and 130 feet directly at White Point. The dredged material was removed in scows and deposited in Nomini Bay near Kingcopsico Point. The dike across the channel to Bushfield Bay, inside White Point, was built of riprap stone, 406 cubic yards having been purchased for this purpose.

In the river and harbor act of July 13, 1892, an appropriation of $10,000 was made for continuing the improvement. Under date of August 8, 1892, proposals were invited for oyster shells and riprap stone and for constructing the jetty on the east side of the channel outside White Point, and a contract for the same entered into with George W. Gray, of Georgetown, D. C., October 14, 1892, the work to be completed December 30, 1892.

The contractor commenced the excavation of the trench for the shore end of the jetty at White Point on December 10, 1892, but some material had been delivered at the site of the work before that date. Soon after this the Potomac was closed by ice, and operations remained suspended until February 20, 1893, when a barge load of stone arrived at the work and unloading was commenced. During the winter the trench had filled with sand, and it was therefore re-excavated. The actual construction of the dike was commenced April 3, 1893. The dike consists of a hearting of oyster shells, covered with riprap stone to the depth of 18 inches. The top of the jetty is at high tide and is 6 feet in width. The side slopes have an inclination of 1½ to 1. Three-fourths of the riprap stone weigh from 400 to 1,000 pounds each, and one-fourth from 100 to 400 pounds each.

On June 30, 1893, the construction of the jetty was in progress, the length completed being 200 linear feet, the time of completion having been extended from December 30, 1892, to July 15, 1893.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

The construction of the jetty was continued in a slow and unsatisfactory manner. In July, 1893, the work was not vigorously prosecuted and there appeared to be a lack of capital and of proper management. On July 7, 1893, a second extension of the time for the completion of the contract was granted to October 15, 1893. During July, 1893, 143 linear feet of jetty were built, making a total of 343 linear feet. On July 27, 1893, the contractor suspended work and on August 19, 1893, removed his plant. Up to this time W. H. Sullivan had been associated with the contractor and had furnished capital and plant for carrying on the same. He now withdrew from the work entirely and the bondsmen, The Fidelity and Deposit Company of Maryland proceeded (after some delay) with the work.

Active operations on the jetty were resumed October 27, 1893. The time of completion was extended to October 31, 1894. Slow progress was made with the work, due partly to unfavorable weather, but chiefly to the bad condition of the plant and the poor management of the contractor who remained in charge of the work for the bondsmen. Operations proceeded in the same slow and unsatisfactory manner until December 14, 1893, when the work was brought to a close for the season. The contractor was required to place riprap on the outer end slope of the jetty to prevent the oyster shells from being washed out by the storms of winter and also to remove his dilapidated scow and plant from the jetty lest they should be carried into the dredged channel by storms. At this date 465 linear feet of jetty had been completed out of a total of 890 linear feet to be built under the contract.

No further work was done during the year.

FUTURE OPERATIONS.

The work remaining to be done under the project is the completion of the jetties and the continuation of the dredging to 150 feet width through the remainder of the bar. The total amount needed to complete the work is $20,000, and this can be profitably expended in one year.

APPROPRIATIONS.

The following appropriations have been made:

May 3, 1873	$10,000	August 2, 1882	$2,000
June 23, 1874	6,000	August 11, 1888	5,000
March 3, 1875	5,000	September 19, 1890	5,000
March 5, 1879	2,500	July 13, 1892	10,000
June 14, 1880	5,000		
March 3, 1881	2,000	Total	52,500

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1893, balance unexpended	$8,622.89
June 30, 1894, amount expended during fiscal year	2,366.95
July 1, 1894, balance unexpended	6,255.94
July 1, 1894, amount covered by uncompleted contracts	5,978.00
July 1, 1894, balance available	277.94
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Tonnage for calendar year—	Tons.
1889	13,542
1890	15,825
1891	62,300
1892	*21,000
1893	17,658

No new lines of transportation were established in 1893. It is reported that the improvement has cheapened freight rates about 25 per cent.

J 6.

IMPROVEMENT OF LOWER MACHODOC CREEK, VIRGINIA.

ORIGINAL CONDITION.

Lower Machodoc Creek is a tidal estuary of the Potomac River, which it enters on the right about 85 miles below Washington, D. C. It is the next stream below Nomini Creek and its mouth is just above

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* This calculation is for sailing vessels only. The steamers carry the great bulk of grain and general merchandise.

Coles Point. The creek lies within Westmoreland County, Va., and has a navigable length of about 4 miles. The width between banks at the mouth is 1 mile, and between the 12-foot contours the channel width exceeds 3,000 feet. The lower part of the creek for a distance of 1½ miles above the mouth is from three-fourths of a mile to 1 mile in width, with a navigable depth of 13 feet, affording a safe harbor during northeast to southeast storms.

At the "Narrows," 2 miles above the mouth, the stream suddenly contracts to a width of 650 feet and the channel is obstructed by a sand bar over which but 4 feet can be carried at low tide. This bar constitutes the principal obstruction to navigation.

On the right there is a projecting spit of sand about 2,000 feet in length, called "Narrows Beach," which makes out from the right bank, extending nearly across the creek and along the entire length of the bar and obstructing and deflecting the natural flow of the tidal currents. A shoal also extends out from Plumb Point, on the left bank of the creek, just below. The bar proper, lying between these projecting points, has a ruling depth of 4.3 feet, the best water being on the extreme right near Narrows Beach. This is the channel used by vessels and it is quite tortuous and difficult to navigate. The distance between the 6-foot contours is 220 feet and between the 8-foot contours about 1,000 feet. In the center of the stream the bar is quite shoal, having a depth of but little more than 1 foot, while on the left the ebb tide has cut a channel nearly 6 feet deep well below Plumb Point. Borings taken at the bar show it to be composed chiefly of sand, with some admixture of mud, clay, and shells.

After passing Narrows Bar a depth of from 10 to 14 feet is found in the channel, gradually shoaling to about 9 feet near Cupelo Point, 3 miles above the mouth, and thence to about 6 feet at Drum Bay, the head of navigation, 4 miles above the mouth. Above the Narrows the bottom is quite soft, and the stream could be navigated by vessels drawing a foot more than the depths above mentioned.

PLAN OF IMPROVEMENT.

The project for the improvement adopted November 29, 1892, provides for dredging a channel 150 feet wide and 9 feet deep at low tide through the bar at the Narrows at an estimated cost of $15,000.

WORK DONE AND RESULTS OBTAINED.

The first appropriation for this work was made in the river and harbor act of July 13, 1892, the amount being $3,000. As no detailed survey of Narrows Bar had ever been made, it was necessary to make such a survey before a project and estimate for the improvement could be prepared. This survey was made in August, 1892. The report of the survey, with map, estimates, and a project for the improvement, were submitted November 22, 1892. The small appropriation of $3,000, made July 13, 1892, was not sufficient for dredging more than a narrow channel through the bar, estimated at 30 feet in width, to the full depth of 9 feet. Such a narrow channel as this would be of little benefit so far as steamboat navigation is concerned and would probably shoal before another appropriation was made. In order, however, to afford the relief asked by the citizens of this locality, the project provided for the application of the available funds to a channel 6 feet deep and 100 or more in width for temporary use until Congress should make further appropriations. Proposals for dredging such a channel were invited by public advertisement and the contract awarded to the lowest bidder, Fred. L. Somers, of Philadelphia, at 21 cents per cubic yard.

Dredging at Narrows Bar was commenced June 6, 1893, and at the close of the fiscal year ending June 30, 1893, was still in progress.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

Dredging operations at Narrows Bar under the above-mentioned contract were continued until it was completed on August 24, 1893, the time for the completion of the contract having been extended to August 30, 1893. The channel as dredged is 6 feet deep at low tide, 150 feet wide, and 750 feet in length. The total amount of material dredged and deposited on the dumping ground behind Narrows Beach was 11,691 cubic yards.

FUTURE OPERATIONS.

For the completion of the work under the project there will remain the additional dredging required to secure a channel 150 feet wide and 9 feet deep through Narrows Bar, the estimated cost being $12,000.

APPROPRIATION.

The following appropriation has been made:

July 13, 1892	$3,000

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1893, balance unexpended	$2,772.35
June 30, 1894, amount expended during fiscal year	2,635.74
July 1, 1894, balance unexpended	136.61
Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	12,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Receipts and shipments.

	1892.	1893.
	Tons.	*Tons.*
Grain	435	330
Oysters	375	[a]6,000
Wood	500	200
Miscellaneous	200	450

[a] The statistics for 1893 were furnished by Messrs. E. P. Barnes, William Mayo, and J. E. R. Crabbe, and the oysters were stated at 150,000 bushels, which is nearly 25 per cent of all the oysters received in the city of Washington during the year and must be an overestimate.

No new lines of transportation were established in 1893.

J 7.

IMPROVEMENT OF PATUXENT RIVER, MARYLAND.

ORIGINAL CONDITION.

The Patuxent River is navigable from its mouth at Drum Point, on the Chesapeake Bay, for a distance of about 46 miles, as far as Bristol, Md. Vessels drawing from 10 to 12 feet can reach Holland Wharf, about 28 miles above the mouth, and a steamer drawing 8.5 feet when fully loaded runs up to Bristol.

Prior to the commencement of the improvement the navigation of the upper part of the river was obstructed by two bars, (1) Swann Point Bar, about 43 miles above the mouth, with a ruling depth of 7.8 feet, and (2) Bristol Bar, at Bristol, with a least depth off the steamboat wharf of 7.6 feet, and 4.2 off the county wharf. Two other bars below, viz, Pope Shoal, about 24 miles above the mouth, and Warren Reach Bar, about 34 miles above the mouth, were mentioned in the report of the preliminary examination as worthy of survey, but they appear to offer no obstruction to the present standard of navigation.

PLAN OF IMPROVEMENT.

The original project proposed a cut of 200 feet wide and from 12 to 13 feet deep through these bars, so as to secure a permanent channel about 100 feet wide and 12 feet deep at low tide, at an estimated cost of $80,000. Under this project a channel 120 feet wide and 12 feet deep was dredged at Bristol Bar. Upon examination of the river in 1890 it appeared that a channel about 100 feet wide and 9 feet deep at Swann Point Bar would afford all the facilities that the existing or immediately prospective demands of commerce would require. The steamer navigating the upper part of the river draws, as stated, but 8.5 feet when fully loaded, but is as a matter of fact never fully loaded when passing this bar. So far as could be learned few sailing vessels go as high up as Bristol, and none drawing as much as 9 feet. The project was therefore modified so as to provide, in addition to the channel already dredged at Bristol Bar, a channel at Swann Point Bar about 100 feet wide and 9 feet deep, to be supplemented by works of contraction if these should afterwards be found necessary.

WORK DONE AND RESULTS OBTAINED.

The first appropriation was made August 11, 1888, amounting to $5,000, which was applied to dredging by contract at Bristol Bar. A channel 12 feet deep, 120 feet wide, and 794 feet long was dredged from the 12-foot curve at the lower end of the bar to a point about 250 feet above the steamboat wharf. The amount of dredging was 18,295 cubic yards, and the channel was completed January 2, 1890. The material was mud.

In the river and harbor act of September 19, 1890, an appropriation of $6,000 was made for this improvement. Under this appropriation dredging by contract at Swann Point Bar was commenced April 9, 1891, and completed June 4, 1891. A channel 9 feet deep and 132 feet wide was dredged through the bar. This width of cutting will give a bottom width of fully 100 feet when the sides of the channel have assumed their natural slope. The total amount of dredging was 19,525.7 cubic yards, which was removed in scows. The dredged channel is about 2,250 feet long.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

A survey of Swann Point and Bristol bars was made in June, 1894. The channel at Swann Point Bar was found to have a depth of 9 feet and a width of 100 feet, and no contracting works appear to be required. At Bristol Bar the available channel is about 100 feet wide, with a general depth of 10 feet or more, except on the northeasterly side and at the upper end where shoaling has occurred. About 8½ feet can be carried to the steamboat wharf.

The work already done on this river is sufficient for its present trade and navigation, and no further appropriations are recommended.

APPROPRIATIONS.

The following appropriations have been made:

August 11, 1888	$5,000
September 19, 1890	6,000
Total	11,000

The work is in the collection district of Annapolis. The nearest light-house is at Drum Point, Md.

Money statement.

July 1, 1893, balance unexpended	$855.87
June 30, 1894, amount expended during fiscal year	473.17
July 1, 1894, balance unexpended	382.70

COMMERCIAL STATISTICS.

Receipts and shipments for calendar year 1893.

	Tons.
Coal	1,200
Lumber	400
Tobacco	1,200
Miscellaneous	3,960
Total	6,760

Arrival and departure of vessels.

	Number.	Tons.
Steam, drawing 10 feet or more	90	300 to 600
Sail, drawing less than 10 feet	20	40 to 100

No new lines of transportation were established in 1893.

J 8.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

DESCRIPTION.

The Rappahannock River is navigable from its mouth in Chesapeake Bay to Fredericksburg, Va., a distance of 106 miles. The lower part of the river has the character of a tidal estuary, the width varying from 1 to 3.5 miles. The ruling depth at the mouth is 5 fathoms, and this depth holds to Jones Point, 28 miles above, while 17 feet can be carried to within 1 mile of Tappahannock, which is 41 miles from the mouth. Above Tappahannock the river has a tortuous course, and above Port Royal, 29 miles from Fredericksburg, it flows between high banks. The width at Fredericksburg is about 350 feet, gradually increasing to about 1,500 feet at Port Royal. In 1871, prior to the inception of the improvement, 6 feet could be carried within a mile of Fredericksburg, and thence 4 feet to the town.

The Rappahannock River drains a large area of agricultural country and is subject to freshets. The highest known freshet occurred in June, 1889, when the river rose to 32.8 feet above low tide at Fredericksburg. The freshet slope falls below Fredericksburg as the river widens. Freshets are but little felt at Port Royal, and not at all at Tappahannock. They bring down large quantities of sediment, and are the chief factors in bar formation. Tides range from 2.5 feet at the mouth to 3.4 feet at Fredericksburg.

ORIGINAL CONDITION.

The obstructions to navigation lie between Tappahannock and Fredericksburg, 65 miles. The original condition of the bars was as follows:

Naylor Hole, 44 miles above the mouth. A detailed survey of the bar made in 1885 showed the least depth to be 10.7 feet. The length of the bar between the 15 foot curves was 11,000 feet. Borings showed sand, mud, and gravel.

Nanzatico Reach, 72 miles above the mouth and 4 miles below Port Royal. The ruling depth on the bar is 10.1 feet (survey of 1885), although in the track which can be conveniently followed by steamers the depth is 8.3 feet. The length of the bar between the 15-foot curves is 5,540 feet. The bar is composed for the most part of soft mud.

Farleyvale Bar, 94 miles above the mouth, and 12 miles below Fredericksburg. In 1881, before improvement, 9 feet could be carried over this bar, although the depth on the best course was 8.3 feet. The bar was composed of sand, mud, and gravel, and was about 200 feet long between the 10-foot curves.

Castle Ferry Bar, 98 miles above the mouth, and 8 miles below Fredericksburg. The least depth in 1876, before improvement, was 8.4 feet, and the length between the 10-foot curves, 1,400 feet. The bar is composed of sand and mud.

Spottswood Bar, 102 miles above the mouth, 4 miles below Fredericksburg. In 1871 this bar was 5,400 feet long, with a least depth of 6 feet at the "cross over," where there were three wrecks sunk during the late war. Before improvement this was the most troublesome bar on the river below Fredericksburg Bar, and steamers often grounded here.

Pratt Reach Bar, 103 miles above the mouth and 3 miles below Fredericksburg. The ruling depth before improvement was 8.1 feet and the length between the 10-foot curves about 1,000 feet. The bar is formed of sand and mud.

Bernard Bar, 104 miles above the mouth and 2 miles below Fredericksburg. The ruling depth before improvement was 9.1 feet, and the length between the 10-foot curves about 400 feet. The material is sand and gravel.

Pollock Bar, 105 miles above the mouth of the river and 1 mile below Fredericksburg. The bar was about 700 feet long in 1882, before its improvement was commenced, and the ruling depth 7 feet. At the head of the bar and near the right bank there was a ledge of rock on which the depth was from 6 to 7 feet.

Fredericksburg Bar.—This bar commences 1 mile below the railroad bridge at Fredericksburg and extends up to and along the entire wharf front of the town to the bridge. The ruling depth in 1871 was 4 feet. The bar was formed and is constantly renewed by deposits of sand brought down by the recurring freshets. In 1871 six wrecks obstructed the channel over this bar.

The navigation of the Rappahannock is sometimes obstructed by trees and snags carried into the river by freshets.

PLAN OF IMPROVEMENT.

The original project, approved in 1871, was to secure a channel 100 feet wide and 10 feet deep by dredging and the construction of dikes from Fredericksburg to Tappahannock, the wrecks obstructing the channel to be removed. The first estimate of the cost of this improvement was $83,760. In 1879 the project was amended so as to provide for dredging a channel 100 feet wide and 10 feet deep through the bars between Fredericksburg and Port Royal and one 200 feet wide and 15 feet deep between Port Royal and Tappahannock for a larger class of vessels. The depths secured by dredging were to be maintained by a system of wing dams and training dikes. The total estimated cost of the revised project was $381,500.

WORK DONE AND RESULTS OBTAINED.

The first appropriation for the improvement was made March 3, 1871, amounting to $15,000. From March 3, 1871, to June 30, 1890, fourteen appropriations have been made, ranging from $5,000 to $25,000, and aggregating $199,500. These appropriations have been expended in improving the seven bars between Fredericksburg and Port Royal by dredging, the construction of dikes, and the removal of wrecks and snags.

The following table gives the results of the improvement at each of the bars at the date of the latest surveys:

Locality.	Depth at low water before improvement.	Ruling channel depth at low water at date of latest survey.
	Feet.	***Feet.***
Fredericksburg Bar, below steamboat wharf	4	8.4 (1892)
Pollock Bar	7.3	9 (1890)
Bernard Bar	8.5	9 (1890)
Pratt Bar	8.3	9 (1890)
Spottswood Bar, upper	6	9.4 (1892)
Spottswood Bar, lower	6	8.8 (1892)
Castle Ferry Bar	8	9.5 (1890)
Farleyvale Bar	8	9.5 (1890)

Nothing has yet been done toward the improvement of the bars at Nanzatico Reach, 33 miles below Fredericksburg, and at Naylor Hole, near Tappahannock, 61 miles below Fredericksburg, as it is considered more important to first complete the improvement above.

Under the appropriation of $15,000 made in the river and harbor act of September 19, 1890, the dikes at Fredericksburg Bar, Pollock Bar, Bernard Bar, Spottswood Bar, and Castle Ferry Bar were repaired.

A combined steam snagging and pile-driving plant was constructed (one-half of the cost being charged to Rappahannock River), and 18,028 cubic yards of sand dredged at Fredericksburg Bar.

An appropriation of $20,000 was made in the river and harbor act of July 13, 1892, for continuing the improvement. As the dimensions of the channel called for by the project between Port Royal and Fredericksburg had not yet been attained, operations were directed to this part of the improvement. Surveys were made at Spottswood Bar and Fredericksburg Bar during August and September, 1892. At Spottswood Bar an increase in the ruling depth was found to have taken place at the lower bar, which had increased from 8 feet in 1890 to 8.8 feet in 1892.

At Fredericksburg Bar, while a slight improvement had been effected by the dredging of 1891, the greater part of the deposit of the freshet of 1889 and subsequent freshets remained to be removed.

Under this appropriation 14 snags were removed between Fredericksburg and Port Royal, and Dikes No. 7, E and F, at Fredericksburg Bar were extended by hired labor and the use of the new pile-driving plant. This work was commenced in September, 1892 and completed in April, 1893, operations having been suspended for two and one-half months during the severe winter of 1892–'93, when ice formed on the river to the unusual thickness of 13 inches. Seven hundred and eleven feet of sheet-pile dike were built, the dikes being intended especially to afford storage for the dredged material.

Surveys made at Spottswood and Fredericksburg bars showed that further dredging operations at Spottswood could be deferred for a time, but that at Fredericksburg dredging would be required to restore the standard depth of 10 feet. As soon as the dikes were sufficiently advanced preparations for the dredging were made. Specifications were prepared for dredging at Fredericksburg Bar, and bids for this work in connection with that at Urbana Creek were invited. The contract for the two works was awarded to G. K. Baker, of Berkley, Va., and entered into March 27, 1893.

Dredging at Fredericksburg Bar was commenced on April 26, 1893, and on June 30, 1893, was still in progress.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

Dredging operations at Fredericksburg Bar, under the above-mentioned contract of G. K. Baker, were continued during July, August, and September, 1893. While favorable progress was made for a part of the time the dredges used by the contractor were very old and in a dilapidated condition, so that frequent breakages and consequent delays for repairs resulted.

An unusually high freshet occurred on September 14, 1893, reaching a maximum height of 21.2 feet. The freshet washed a large amount of material from behind the dikes and caused a shoaling of from 1 to 2 feet in the upper part of the dredged channel. The dredging was practically completed on the date of the expiration of the contract, October 1, 1893, the only work done after this being the removal of lumps, etc., found on the final examination.

The channel was dredged to the full width of 100 feet and the required depth of 10 feet at low tide between the steamboat wharf and Hazel Run, a distance of 2,500 feet. Below Hazel Run to Deep Run, a distance of 2,200 feet, the channel was dredged 67 feet wide and 10 feet deep. Below Deep Run, the lower end of the bar was dredged so as to widen the natural channel and facilitate the passage of steamers around the sharp turn at the lower end of Fredericksburg Reach. The total amount of dredging paid for under the contract was 39,669.7 cubic yards. The available funds were insufficient for redredging the part of the channel which shoaled during the freshet of September 14, 1893.

In order to protect the sand deposited behind the dikes during freshets and prevent it from being carried into the river, brush fences were built behind Dikes No. 7, E and F, by hired labor. This work was commenced November 3, 1893, and completed December 12, 1893. Five thousand six hundred and twenty-nine linear feet of fence were built at a cost of 7.6 cents per linear foot.

In April, 1894, 2,737 willow shoots and cuttings were planted over the filling so as to induce a growth of protecting trees and together with the fences to facilitate the gradual deposit of soil.

FUTURE OPERATIONS.

The work remaining to be done under the project is the improvement of the two bars between Port Royal and Fredericksburg and the dredging and dike construction necessary to secure and maintain a channel 10 feet deep and 100 feet wide through the seven bars between Fredericksburg and Port Royal. As each freshet brings new deposits of sand and silt into the river, particularly at Fredericksburg Bar, the head of tide water, an annual appropriation of about $7,500 will be required for its maintenance.

The increased expenditures at and near the head of navigation due to this cause have so encroached upon the general estimate for the improvement of the river that a revision and increase of the same has become necessary.

APPROPRIATIONS.

The following appropriations have been made:

March 3, 1871	$15,000	August 2, 1882	$17,000
June 10, 1872	15,000	July 5, 1884	20,000
March 3, 1873	15,000	August 5, 1886	20,000
June 23, 1874	7,000	August 11, 1888 ($15,000, of which $3,000 was for Urbana)	12,000
March 3, 1875	5,000	September 19, 1890	15,000
August 14, 1876	10,000	July 13, 1892	20,000
June 18, 1878	13,500		
March 3, 1879	10,000	Total	234,500
June 14, 1880	25,000		
March 3, 1881	15,000		

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blakistone Island.

Money statement.

July 1, 1893, balance unexpended	$14,768.73
June 30, 1894, amount expended during fiscal year	11,403.41
July 1, 1894, balance unexpended	3,365.32
July 1, 1894, outstanding liabilities	[*] 1,929.00
July 1, 1894, balance available	1,436.32
Amount (estimated) required for completion of existing project	147,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

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[*] $1,916.97 due on contract with George E. Ward, dated April 5,

COMMERCIAL STATISTICS.

Tonnage for—	Tons.
1888	83,600
1890	83,830
1892	*126,333
1893	*141,750

No new lines of transportation were established during the year 1893.

The freight rates are greatly affected by water line competition and it is reported that the tendency to increased facilities of navigation has been to greatly reduce them.

J 9.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

ORIGINAL CONDITION.

Urbana Creek is a tributary of the Rappahannock River, which it enters 16 miles above the mouth. Navigation was obstructed in 1874 by a bar outside the mouth, over which but 6.5 feet could be carried. In 1882, after the improvement had been commenced, a shoal within the creek having a least depth of 7 feet, and near the town of Urbana, was regarded as an obstruction to steamboat navigation.

PLAN OF IMPROVEMENT.

The approved project, adopted in 1879, was the excavation of a channel 150 feet wide and 10 feet deep through the outer bar, at an estimated cost of $20,000. The project was modified in 1883 so as to include dredging a channel through the shoal within the creek, and in 1888 so as to include a system of dikes or jetties along the sand spit at the mouth, to prevent the natural channel from closing. The revised estimate for the entire project was $34,580.

WORK DONE AND RESULTS OBTAINED.

From March 3, 1879, to August 11, 1888, five appropriations, ranging from $2,500 to $5,000, and aggregating $18,000, were made and expended in dredging channels through the bar outside the mouth, and the shoal within the creek, and in the construction of dikes and jetties on the sand spit. From 1883 to 1889 work was suspended for want of funds.

In 1882 the channel through the outer bar had been dredged to a width of 140 feet and a depth of 10 feet, but owing to the action of storms and the cessation of work the width had diminished to 90 feet. The natural channel has been widened at the end of the sand spit and at the turn just outside the spit. A channel 10 feet deep and from 80 to 170 feet wide has been dredged at the shoal inside the creek. Two jetties and a dike have been built on the sand spit.

Under the appropriation of $3,000, made September 19, 1890, 5,674 cubic yards of material were dredged from the end of the sand spit and the width of the natural channel at this point increased 70 feet. The depth made was 10 feet at low tide. An appropriation of $3,000 was made July 13, 1892. A survey of the channel through the outer bar made in November, 1892, showed that shoaling had occurred, so that the depth ranged from 8.5 to 9.5 feet, while the width was about 110 feet. Proposals for deepening and widening the channel and for

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* Furnished by Mr. William D. Scott, Fredericksburg, Va.

dredging at Fredericksburg Bar, Rappahannock River, under one contract, were invited by public advertisement. The contract was awarded to G. K. Baker, of Berkley, Va., and entered into March 27, 1893.

Dredging was commenced April 19, 1893. The plant employed by the contractor was old and worn out, and frequent delays occurred from breakage of machinery and similar causes. Further delay resulted from the difficulty of procuring fresh water. On June 30, 1893, a channel 10 feet deep and 120 feet wide was nearly completed through the outer bar. The work was chiefly redredging.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

Dredging operations under the contract of G. K. Baker were continued in July, 1893, and a channel through the outer bar 10 feet deep and 120 feet wide was completed July 15, 1893. Nineteen thousand two hundred and eighty-five cubic yards of material were removed and deposited in deep water in Rappahannock River.

FUTURE OPERATIONS.

For the completion of the work under the existing project there remains the further dredging of the channel through the outer bar and the shoal within the creek and the construction of jetties. Owing to the exposed position of the outer bar it will be difficult to maintain a channel through it. Past experience shows that without protecting works a dredged channel must eventually shoal from the action of the east to northeast storms, while protecting works in such an exposed locality must necessarily be expensive. The improvement made has been of benefit to navigation by permitting the entrance of sailing vessels to the creek, while one of the steamers of the Weems Line now enters Urbana Creek through the channel and lands directly at the town instead of at the Urbana wharf on the Rappahannock, 1.5 miles from the town. The appropriations heretofore made for this work have been so small that advantageous contracts could not be made, while the continued shoaling from the action of storms on the outer channel has required a large amount of redredging. The estimates for this improvement were revised in 1888 and it was then proposed to build a brush and shell jetty at the outer bar. The location is so exposed, however, that it is believed that such a construction would soon be destroyed by storms and that to insure a permanent improvement provision must be made for a jetty of shells covered with heavy riprap stone. In view of the above considerations a revision of the estimate has become necessary.

APPROPRIATIONS.

The following appropriations have been made:

March 3, 1879	$5,000
June 14, 1880	2,500
March 3, 1881	4,000
August 2, 1882	4,000
August 11, 1888 (included in an appropriation of $15,000 for Rappahannock River)	3,000
September 19, 1890	3,000
July 13, 1892	3,000
Total	24,500

Urbana is a port of entry in the collection district of Tappahannock. The nearest light-house is that at Bowler Rock.

Money statement.

July 1, 1893, balance unexpended	$2,293.52
June 30, 1894, amount expended during fiscal year	2,277.63
July 1, 1894, balance unexpended	15.89
Amount (estimated) required for completion of existing project	10,080.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,080.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Tonnage for calender year—	Tons.
1890	5,350
1891:	
Reported by Mr. F. A. Bristow as	19,500
Reported by Mr. J. D. Gressit as	22,100
1892	20,095
1893:	
Reported by Mr. F. A. Bristow as	55,885
Reported by Mr. J. D. Gressit as	61,290

A new steamer line from Baltimore, Md., making two trips per week was established during the year.

It is reported that the work done thus far has cheapened freight rates and permitted the use of larger vessels.

J 10.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

ORIGINAL CONDITION.

The York River is formed by the union of the Mattaponi and Pamunkey rivers at West Point, Va., is 41 miles in length, and empties into Chesapeake Bay about 16 miles above Old Point. Entering the river 24 feet can be carried for 32 miles up to Potopotank Bar, 9 miles below West Point. In 1880 the ruling depth on this bar was 18.5 feet, and its length between the 20-foot curves was 2,200 feet. The next obstruction to navigation is West Point Bar, which commences about 2 miles below West Point and extends up to West Point, with a ruling depth of 15.5 feet. West Point is the shipping point of the Richmond and West Point Terminal Railroad system. The wharves from which shipments are made are built within the mouth of Pamunkey River, and further obstruction to navigation was found in shoal water in front of these wharves.

PLAN OF IMPROVEMENT.

The original project adopted in 1880 proposed the dredging of a channel 22 feet deep and 200 feet wide through the bars at Potopotank and West Point, with an increased width at the wharves at West Point. In 1884, on account of the increased trade, the project was modified by increasing the width of the proposed channel to 400 feet, at a total estimated cost of $256,000. In 1887 the project was again amended to include the construction of a dike along the right bank of the river at West Point Bar, in order to prevent the deposit of silt in the dredged channel. The estimated cost of this dike was $52,800, making the total estimated cost of the improvement $308,800.

WORK DONE AND RESULTS OBTAINED.

From June 14, 1880, to August 11, 1888, six appropriations, ranging from $10,000 to $30,000, and aggregating $128,750, were made for this improvement.

Up to June 30, 1890, the following work had been done: A channel 105 feet wide and 22 feet deep was dredged in 1880–'81 through Potopotank Bar, 58,809 cubic yards of material having been dredged, at 15 cents per cubic yard. This channel in January, 1890, had a depth of from 20.8 to 21.7 feet.

At West Point Bar 795,704 cubic yards were dredged from 1881 to 1889, under successive appropriations, at rates varying from 8.5 to 16 cents per cubic yard, which gave a channel through the bar with a width varying from 161 to 257 feet, and a depth, exclusive of the center cut, of not less than 22 feet. Under a modification of the project by the Secretary of War, January 4, 1889, a cut of 40 feet wide and 24 feet deep was dredged near the center of the channel from the lower wharf at West Point to the second turn in the channel. In January, 1890, the ruling depth in this cut had been reduced by silting to 20.6 feet and in the rest of the channel to 19 feet. From the commencement of the improvement in 1881 to June 30, 1890, it had been necessary to redredge 152,595 cubic yards of silting, which was not provided for in the original estimate, or about one-fifth of the total amount dredged at West Point Bar.

Under the appropriation of $30,000, made September 19, 1890, 166,130 cubic yards of material were dredged from the channel at West Point Bar, of which 95,173 cubic yards were redredging. A channel 160 feet wide, 22 feet deep, and 2,700 feet long was dredged in front of the West Point wharves, and the channel between and near Buoys 13 and 15 was redredged for a distance of about 3,300 feet, the width made being 160 feet and the depth 22 feet. Up to June 30, 1893, the total amount of dredging at West Point Bar was 961.834 cubic yards, of which 247,768 cubic yards were redredging. It was evident from this result that early action must be taken in the matter of constructing the dike proposed in the project in order, if possible, to prevent further deposits in the dredged channel.

On July 13, 1892, a further appropriation of $35,000 was made, which, together with a balance reserved from the appropriation of September 19, 1890, was allotted to the construction of the dike at West Point Bar on the right of the channel. A survey of the West Point Bar was made in September, 1892, and test piles driven near the proposed line of dike. The survey showed a ruling depth of practically 20 feet, and indicated that the shoaling still continued.

Plans and specifications for the dike having been prepared, proposals for the work were invited by public advertisement.

The contract was awarded to Sanford & Brooks, of Baltimore, Md., and entered into March 29, 1893. The construction of the dike was commenced May 24, 1893, and at the close of the fiscal year ending June 30, 1893, was in progress.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

The dike at West Point Bar is located on the edge of the flats on the right of the channel, in depth of from 3 to 8 feet of water at low tide. It is built as follows: Two rows of round piles were first driven, the piles of each row being 8 feet apart and the two rows (front and rear)

10 feet apart from center to center. The piles of the front row are anchored to those of the rear row by means of 1¼-inch iron rods and chains. Along the inside of the front row of piles are secured, in suitable notches, two wales, the lower wale being 4 by 12-inch timber with the top at low-water mark, and the upper wale 6 by 12-inch timber with the top 3 feet above low-water mark. Along the inside of these wales 3-inch sheet piling are driven and spiked to the wales, the joints in the sheet piling being covered with strips of 2-inch by 5-inch planking. A 2 by 12-inch guard plank is spiked to the inside of the sheet piling at the top of the dike. The round piles are of long leaved pine, while the wales, sheet piling, strips and guard plank are of white oak. Owing to the soft character of the bed of the river, it was necessary to use very long piles.

The dike was of two classes. Class A was built in depths of 6 feet or less, the round piles being 50 feet long and the sheet piling 16 feet long; Class B was built in depths of more than 6 feet, the round piles being 60 feet long and the sheet piling 20 feet long. In other respects the two classes varied only in the length of strips and anchor ties.

The contractors commenced operations by driving round piles, and this branch of work continued from May 28, 1893, until August 30, 1893, when all the round piles had been driven. This work was carelessly done, the piles not being accurately spaced nor in good alignment, causing much difficulty in the later stages of the construction. The work of notching piles was commenced June 5, 1893, while the first lower wales were put on June 13, 1893. On June 27, 1893, the contractors commenced putting on anchor ties. These ties are secured to the piles in the front row by elliptical rings of 1¼-inch round iron, which varied in dimensions with the diameter of the piles. Drawings of these rings, for piles of various diameters, were furnished the contractors who had the ties, with rings of several sizes made in advance and shipped to the work. Most of the piles proved to be smaller than they had anticipated, however, and about one-half the rings on the dike are too large.

On August 28–29, 1893, a severe storm occurred, but did no damage to the work. On September 6, 1893, the contractors commenced driving sheet piling. The sheet piling drove very easily in the soft bottom, and required only the weight of the hammer to force it down. On September 7, 1893, two-thirds of the wale had been put on. This part of the work was greatly delayed by the unusually high tides, which continued during the entire season. This was the case not only upon the York but upon the Rappahannock and Potomac rivers. In putting on the wale the contractors attempted to correct the defective aligment of the piles by drawing them or bracing them into line and then securing the wales and subsequently driving the sheet piling. This method proved unsuccessful, however, for the piles soon sprang back to their original positions, drawing the spikes from the wales and sheet piling and leaving much of the dike in a very imperfect condition.

On October 13, 1893, occurred one of the severest storms ever known in this locality, during which the tide rose to a height of 6.4 feet. The storm partly washed out 736 linear feet of uncompleted dike and damaged 114 feet more. It also eroded the bed of the river along the dike for a depth of from 3 to 5 feet and a width of 10 feet. During the storm a scow and row boat belonging to the United States plant were wrecked. Under the terms of the specifications the contractors were required to make good any damage from the action of the elements prior to the acceptance of the work, which they proceeded to do. On October 27, 1893, all the wale was in position. The time for the completion of the contract was extended three months, from October 18, 1893, or until January 18, 1894. The repairs of the damage done by the storm of October 13, 1893, were completed November 11, 1893. On December 1, 1893, 3,852 linear feet of dike had been built, and on December 31, 1893, 5,736 linear feet had been built out of a total of 7,456 linear feet. The time for the completion of the contract was extended to March 17, 1894. About half of the month of January, 1894, with favorable tides, was lost for want of sheet piling. During the low tides of this month, caused by northwest winds, a careful and detailed inspection was made of the lower wale and the spiking of the sheet piling thereto. It was found that for the reasons above cited there were many places in which the sheet piling did not touch the lower wale, while in others the wale and sheet piling together had drawn away from the pile. Many joints did not bear upon the pile. Under the provisions of the specifications which required the correction of any imperfect work found before its final acceptance, the contractors were notified to correct this imperfect work. This they declined to do. They proceeded to build the remainder of the dike to the lower end, and then withdrew their force and plant from the work.

Under the provisions of the specifications a force was organized and the correction of the imperfect work was proceeded with by hired labor and the use of the United States plant. This work was commenced March 5, 1894, and completed May 18, 1894. Three hundred and four linear feet of sheet piling were drawn and redriven, 2,604 linear feet of sheet piling were respiked, 208 bolts put in, and 20 joints were reinforced.

The length of the dike built under the contract was as follows:

	Linear feet.
Class A	3,972
Class B	3,484.4
Total	7,456.4

In addition to the above, 183 linear feet of shore connection were built in September, 1893, by hired labor. Fascines weighted with sand in bags were placed along that part of the dike where the bed of the river was eroded by the storm of October 13, 1893, by hired labor. Fender piles were also driven along the front of the dike.

FUTURE OPERATIONS.

Future operations proposed are the completion of the channels at West Point and Potopotank bars, and of the dike at West Point Bar in order to maintain the channel secured by dredging.

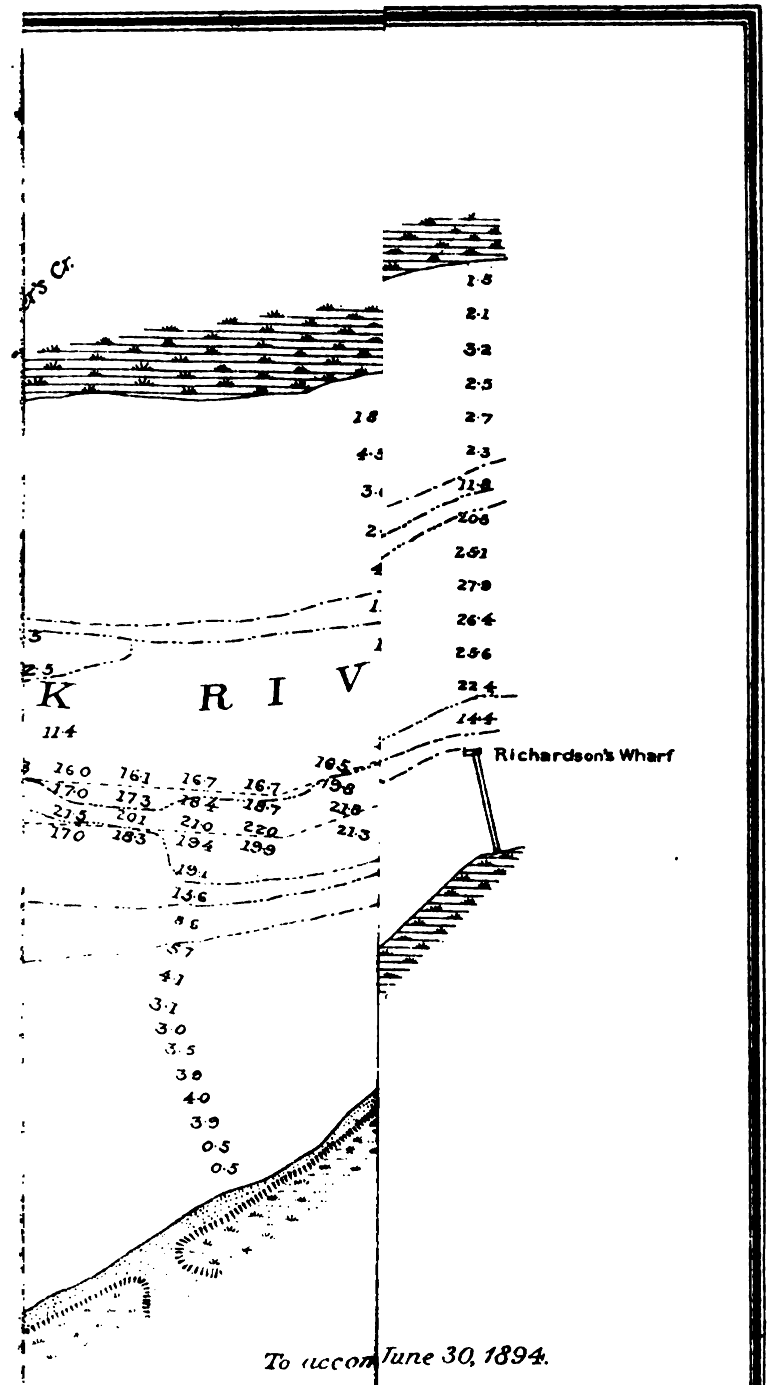
On the basis of the original estimate the amount required for the completion of the project is $115,050, but owing to the continued shoaling of the channel this amount will probably be insufficient.

The trade of the York River is large, increasing, and important, and the improvement is worthy of liberal appropriations by Congress.

APPROPRIATIONS.

The following appropriations have been made:

June 14, 1880	$10,000
March 3, 1881	25,000
August 2, 1882	25,000
July 5, 1884	20,000
August 5, 1886	18,750



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August 11, 1888	$30,000
September 19, 1890	30,000
July 13, 1892	35,000
Total	193,750

This work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, in the Fifth light-house district.

Money statement.

July 1, 1893, balance unexpended		$45,472.40
June 30, 1894, amount expended during fiscal year		35,822.88
July 1, 1894, balance unexpended		9,649.52
July 1, 1894, outstanding liabilities	$50.00	
July 1, 1894, amount covered by uncompleted contracts	5,330.42	
		5,380.42
July 1, 1894, balance available		4,269.10
Amount (estimated) required for completion of existing project		115,050.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, West Point, Va.]

Receipts and shipments.

Class of goods.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
Coal	10,960	10,498	10,423
Cotton	89,227	63,742	67,485
Farm produce	5,641	3,500	4,000
Grain	3,220	....	100
Iron	43,897	45,501	45,033
Lumber	7,848	6,081	7,375
Oysters	12,400	2,780	3,200
General merchandise	70,930	191,462	188,054
Railroad ties	14,140	5,000	6,500
Tobacco	175	8,500	10,000
Wood	45,900	8,495	9,220

Vessels arriving and departing.

	1891.	1892.	1893.
Steamers drawing 10 feet or more	727	724	792
Steamers drawing less than 10 feet	104	208	311
Vessels drawing 10 feet or more	178	96	90
Vessels drawing less than 10 feet	824	190	204
Barges, flatboats, etc	191	18	21

Statement of tonnage by years.

Reported for—	Tons.
1888	285,480
1889	328,353
1890	418,190
1891	304,338
1892	345,559
1893	351,390

No new lines of transportation were established in 1893, but it is reported that the established lines have increased their service, giving much better satisfaction, and that the work done has benefited shipping to a great extent.

J 11.

IMPROVEMENT OF MATTAPONI RIVER, VIRGINIA.

The Mattaponi River is navigable for small steamers and vessels from its mouth, at West Point, to Ayletts, a distance of about 52 miles, and can be made navigable for barges for 26 miles above Ayletts to Munday bridge. The obstructions to 5.5-foot navigation below Ayletts are as follows:

Designation.	Approximate distance below Ayletts.	Length of bar.	Ruling depth.
	Miles.	*Feet.*	*Feet.*
Latane Bar	11	2,900	3.6
Robinson Bar	8	3,500	3.4
Presque Isle Bar	7	1,200	2
Sale Bar	6½	800	2
Walker Bar	4	1,000	2.5
Old Hall Bar	1	909	2.5

Of the above-named bars only the first two have been surveyed, and the lengths and depths of the others are approximate only. Above Ayletts there were eight bars, but no work on them was proposed. The river was also obstructed by snags, overhanging trees and wrecks.

PLAN OF IMPROVEMENT.

The original project, adopted in 1880, provided for the removal of snags, logs, leaning trees, wrecks, etc., below Munday bridge and the improvement of the bars below Ayletts, so as to give a depth of 5.5 feet at low tide and a channel width of 40 feet.

This project was amended by the terms of the river and harbor act of July 13, 1892, so as to provide for the removal of snags up as far as Guineas bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad.

WORK DONE AND RESULTS OBTAINED.

From June 14, 1880, to August 11, 1888, five appropriations, ranging from $2,500 to $5,000 and aggregating $16,300, had been made for this work and the entire amount expended. On June 30, 1890, the following results had been obtained: Snags, wrecks, and overhanging trees had been removed from Robinson Bar to Munday bridge, a distance of about 34 miles, and 2,226 linear feet of dike had been built at Robinson Bar. No dredging had yet been done on the river.

The appropriation of $3,000, made September 19, 1890, was applied in part to the construction of a plant consisting of a combined snag boat and pile-driver, with scows, etc., to be used in the Mattaponi, Pamunkey, and Rappahannock rivers, and in part to the removal of 402 snags, logs, and overhanging trees between West Point and Dunkirk.

On July 13, 1892, an appropriation of $4,000 was made, as follows: "Improving Mattaponi River Virginia: Continuing improvement, $4,000, of which $1,500 shall be expended between Ayletts and Guineas bridges."

The plant which had been employed in dike construction on Rappahannock River was transferred to the Mattaponi River in May, 1893, and the removal of snags and similar obstructions to navigation commenced. At the close of the fiscal year ending June 30, 1893, 208 snags, 97 logs, and 108 overhanging trees had been removed and the work was still in progress. The snag boat had reached a point 5 miles above Dunkirk, when shoal water and a falling river prevented further progress upstream.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

Snagging operations were continued during July, 1893, the boat moving downstream and taking out all snags and similar obstructions found. West Point was reached July 28, 1893, and operations suspended for the season. During July, 1893, there were removed 66 snags, 41 drift logs, and 16 overhanging trees.

FUTURE OPERATIONS.

The remaining work under the existing project is as follows: The completion of the dikes at Robinson Bar and the construction of those proposed at Latane Bar, and the dredging of channels at all of the bars below Ayletts having a ruling depth of less than 5.5 feet. Snags and fallen trees accumulate each year and will require removal. The estimated amount required for the completion of the existing project is $48,800, but as instrumental surveys have been made at but 2 bars, and as the original project has been extended by Congress, this estimate will be subject to future revision.

APPROPRIATIONS.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	3,300
July 5, 1884	2,500
August 5, 1886	5,000
August 11, 1888	3,000
September 19, 1890	3,000
July 13, 1892	4,000
Total	23,300

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1893, balance unexpended	$3,201.70
June 30, 1894, amount expended during fiscal year	866.81
July 1, 1894, balance unexpended	2,334.89
Amount (estimated) required for completion of existing project	48,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Receipts and shipments.

Class of goods.	Calendar years.			
	1890.	1891.*	1892.*	1893.*
	Tons.	*Tons.*	*Tons.*	*Tons.*
Farm products	....	2,400	....	300
Grain	....	1,000	....	100
Lumber	7.700	1.200	5,500	6.200
Merchandise	10,400	3,120	15.576	17,820
Ties	6,900	5,640	5,000	5,260
Wood	7,650	38.700	6.620	6,740
Total	32,650	52,060	32.690	36.420

* Furnished by Mr. E. T. Lamb, West Point, Va.

Vessels arriving and departing during 1893.

Designation.	Number.	Tonnage.
Steam, drawing less than 10 feet	208	10,400
Sail, drawing 10 feet or more	90	30.000
Sail, drawing less than 10 feet	6	12,300
Barges, flatboats, etc	21	1.200
Total	381	53,900

No new lines of transportation were established during the year.

J 12.

IMPROVEMENT OF PAMUNKEY RIVER, VIRGINIA.

The Pamunkey River is navigable from its mouth at West Point, on the York River, to Hanovertown or Dabney Ferry, a distance of about 59 miles. Seven feet can be carried to Piping Tree Ferry a distance of 43 miles. The following are the principal bars obstructing navigation:

Designation.	Distance above West Point.	Length of bar.	Least depth.
	Miles.	*Feet.*	*Feet.*
Spring Bar	43.5	700	5.6
Skidmore Bar	47.5	600	5.8
Whaleback Bar	53.5	700	3
Potomoy Creek	56	400	1.5
Indian Table	58	....	(*)

(*) Exposed at low tide.

In addition to these bars, navigation was originally obstructed by numerous wrecks, logs, snags, and overhanging trees.

PLAN OF IMPROVEMENT.

The project for the improvement, adopted in 1880 and amended in 1885, provided for 7-foot navigation from West Point to Bassett Ferry, 47 miles; thence 5-foot navigation to Wormley Landing, 54 miles above West Point and thence 3-foot navigation to Hanovertown, the 7-foot channel to be 100 feet wide and the remainder 40 feet wide.

The wrecks, snags, logs, and trees obstructing navigation between Garlick Ferry and Hanovertown were also to be removed.

WORK DONE AND RESULTS OBTAINED.

From June 14, 1880, to August 11, 1888, five appropriations were made, ranging from $2,500 to $5,000, and aggregating $15,500. The following work has been done: Snags, logs, and overhanging trees have been removed from the river between Hanovertown and Garlick Ferry, a distance of 22.5 miles. Parts of wrecks obstructing navigation have been removed, as follows: Three at Skidmore Bar, 3 at Carter Island, and 1 at White House. Nine hundred and eleven feet of dike have been constructed at Skidmore and Spring bars, and a channel 800 feet long, 95 feet wide, and from 6 to 7 feet deep has been dredged through Skidmore Bar.

The appropriation of $[illegible],000, made September 19, 1890, was applied in part to the construction of a new plant consisting of a combined snag boat and pile-driver with scows, etc., for use on the Pamunkey, Mattaponi, and Rappahannock rivers, and in part to the removal of 243 snags, logs, and overhanging trees obstructing navigation. On July 13, 1892, a further appropriation of $3,000 was made.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1894.

The snagging plant was refitted at West Point after the completion of the season's work on the Mattaponi River. It left West Point August 1, 1893, and proceeded up the Pamunkey 51 miles to New Castle, where snagging operations were commenced, the boat working up stream. Hanovertown, the upper limit of the improvement, 59 miles from West Point, was reached August 12, 1893. The plant then proceeded down the river, continuing the removal of snags and similar obstructions as far as White House, a distance of 30 miles. Below White House no snags were observed. The obstructions removed were as follows: 51 snags, 23 logs, and 80 overhanging trees. Upon the completion of this work the plant was laid up at West Point under the care of a watchman.

FUTURE OPERATIONS.

The work remaining to complete the project is the dredging of channels at Spring Bar and at the three unimproved bars above, with such further work in removing obstructions as may be found necessary. The estimated cost of completing the project is $7,000, and if dredging operations are to be resumed, this amount should be appropriated at one time. It is not improbable that, owing to the cost of snagging operations and the plant therefor and the small appropriations heretofore made, the cost of the work may be greater than the present estimates.

APPROPRIATIONS.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	2,500
August 2, 1882	2,500
August 5, 1886	5,000
August 11, 1888	3,000
September 1, 1890	3,000
July 13, 1892	3,000
Total	21,500

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1893, balance unexpended	$3,000.00
June 30, 1894, amount expended during fiscal year	381.02
July 1, 1894, balance unexpended	2,618.98
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, West Point, Va.]

Receipts and shipments for calendar year 1893.

	Tons.
Grain	75
Ice	5,145
General merchandise	100
Lumber	10,000
Railroad ties	15,000
Wood	20,100
Total	50,420

No new lines of transportation were established in 1893.

J 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK OF SCHOONER SAMUEL W. THOMAS IN ST. GEORGES RIVER, MARYLAND.

The schooner *Samuel W. Thomas* sank in St. Georges Creek, Maryland, on June 21, 1893. The wreck was reported to the collector of the port of Annapolis as dangerous to navigation, by the owner of the vessel, and this report was referred to the Chief of Engineers, by the Superintendent of the Life-Saving Service, October 4, 1893, and on October 6, 1893, referred to this office for report. On October 12, 1893, an allotment of $20 was made to defray the expenses of an examination. The examination was made and a report thereon submitted October 20, 1893. The wreck was found in from 10½ to 11 feet of water in a small bay on the north shore of St. Georges Island, about one-half mile above the mouth of the river at Cherryfield Point, and about one-fourth mile from shore.

The vessel was built of wood, was 45 feet long, 18 feet beam with 7 feet depth of hold, had a registered tonnage of $22\frac{81}{100}$ tons, and was 36 years old. The depth of water over the wreck was from 3 to 6 feet. There was no cargo. The harbor was used as an anchorage ground by small oyster vessels owned by residents of St. Georges Island and by vessels coming into the river to buy oysters. The estimated cost of removal was $1,500.

Under date of November 9, 1893, proposals were invited for removing the wreck. The bids were opened December 9, 1893, and an abstract of them will be found appended to this report. Seven proposals were received ranging from $272 to $800. The lowest bidder proposed to raise the wreck whole and retain it as his property, a condition which did not conform to the law nor to the provisions of the specifications. The lowest bid was therefore rejected and the contract awarded to the next lowest bidders, Messrs. Kelly & Van Sant, of Atlantic City, N. J. The contract was dated December 16, 1893, the contract price being $323. Work on the wreck was commenced December 28, 1893. It was blown up with dynamite exploded by an electric battery. Eleven charges were fired requiring in all about 175 pounds of No. 1 dynamite. The wreck was well broken up and the pieces removed. The site was then carefully examined by the inspector, both by a drag line and by soundings. It was found that all portions of the wreck had been removed to the level of the bed of the river, leaving a depth of from 11 to 13 feet of water. Operations were suspended December 31, 1893.

The total cost of the work including advertising, inspection and other contingent expenses was $498.79.

Abstract of proposals for removal of wreck of schooner Samuel W. Thomas, in St. Georges River, Maryland.

No.	Name and address of bidder.	Amount.	Commence.	Complete.
1	Cyrus E. Hipple, Conshohocken, Pa..	$272	As soon as notified of acceptance.	Within ten days thereafter.
2	Kelly & Van Sant. Atlantic City, N. J..	323	As soon as bonds are accepted.	In 15 days or less.
3	Enoch Towsend, Somers Point, N. J...	365	....	Jan. 15, 1893. [4]
4	D. A. Johnston, New York City	375	Jan. 1, 1894	Feb. 1, 1894.
5	Samuel S. Richardson. Washington, D. C.	397	Dec. 15, 1893	Dec. 30, 1893.
6	Louis E. Broom, Baltimore, Md	450	Dec. 12, 1893	Dec. 24, 1893.
7	W. H. French, Berkley, Va	800	Immediately after notification.	In 10 days.

WRECK OF STEAMER W. W. COIT.

Wreck of steamer *W. W. Coit* in the Washington Channel of the Potomac River at Washington, D. C. The wooden side-wheel steamer *W. W. Coit* was burned to the water line while at anchor in the Washington Channel of the Potomac River on November [illegible] 1893, and the hull soon after sank in from 13 to 16 feet of water, about 500 feet off the Oyster Wharf at the foot of Eleventh street SW., constituting a dangerous obstruction to navigation. The steamer was 172 feet long, 26 feet beam, with 9 feet depth of hold, and had a registered gross tonnage of 484.72 tons. She was built at Mystic, Conn., in 1864 and was used as a passenger and freight steamer. The wreck was reported to the Chief of Engineers, November 15, 1893, and an allotment of $3,500 was made for its removal November 18, 1893.

By public advertisement of December 2, 1893, due notice was given to parties interested, as required by law, and proposals for the removal of the wreck invited. The bids were opened January 2, 1894. Nine bids were received ranging from $1,137 to $3,812, an abstract of which will be found appended to this report. The contract was awarded to the lowest bidder, John Austin, of Philadelphia, Pa., and entered into January 9, 1894, the contract price being $1,137. The date of commencement was January 10, 1894, and the date of completion was February 10, 1894. Actual operations were not commenced until January 22, 1894. A row of piles was driven on each side of the center of the hull and capped with heavy timber to serve as a trestle for the attachment of chains used in raising the engine, boiler, etc. On February 2, operations were suspended, as the contractor had not paid his employés or the bills incurred by his representative, but were resumed a few days later. The time for the completion of the contract was, at the request of the contractor, extended thirty days to March 10, 1894, all expenses for inspection during the extended term to be charged to him. The work proceeded very slowly and on February 13, was again suspended, only the shaft, walking beam, and a few pieces of the engine having been taken off. Work remained suspended until March 10, 1894, when it was resumed. The time for completion was again extended thirty days to April 10, 1894, under the same conditions that the cost of inspection, etc., should be charged to the contractor. The boiler was removed March 15, 1894, and on March 20, 1894, the engine had been taken out. On March 31, 1894, about one-third of the hull had been taken up. A third extension of the time for the completion of the contract was granted to May 10, 1894, but the work proceeded slowly. On April 3, the plant used on the work was withdrawn and operations were not resumed until April 28, 1894. On June 21, 1894, the work was finally completed, an extension of time to that date having been granted.

The total cost of the work including advertising, inspection, and other contingent expenses, was $1,418.98.

Abstract of proposals for removal of wreck of steamer W. W. Coit, in the Potomac River.

No.	Name and address of bidder.	Amount.	Commence.	Complete.
1	John Austin, Philadelphia, Pa	1,137	Jan. 10, 1894	Feb. 10, 1894.
2	Kelly & Van Sant, Atlantic City, N. J.	*1,411	As soon as bonds are accepted.	In 60 days.
3	Samuel S. Richardson, Washington, D. C.	1,473	Jan. 10, 1894	Feb. 21, 1894.
4	D. A. Johnston, Camden, N. J	1,700	Feb. 1, 1894	Apr. 15, 1894.
5	Louis E. Broom, Baltimore, Md	2,000	In 10 days	In 40 days thereafter.
6	C. W. Johnston and Enoch Townsend, Somers Point, N. J.	2,134	Jan. 20, 1894	Mar. 20, 1894.
7	Lewis H. Skinner, Wilmington, N. C.	2,400	Jan. 31, 1894	May 31, 1894.
8	W. H. French, Norfolk, Va	2,490	Mar. 1, 1894	By Apr. 15, 1894.
9	D. V. Howell, New York City	2,700	Jan. 20, 1894	Mar. 15, 1894.

* Alternative bid $3,812.

APPENDIX K.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

REPORT OF CAPT. EDWARD BURR, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor of Norfolk and its approaches, Virginia.
2. Approach to Norfolk Harbor and the United States navy-yard at Norfolk, Va.
3. Nansemond River, Virginia.
4. Chickahominy River, Virginia.
5. Appomattox River, Virginia.
6. Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.
7. North Landing River, Virginia and North Carolina.
8. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., July 11, 1894.

GENERAL: I have the honor to transmit herewith the annual reports for the fiscal year ending June 30, 1894, upon the works of river and harbor improvement in my charge.

Very respectfully, your obedient servant,

EDW. BURR,
First Lieut., Corps of Engineers.

Brig.-Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

K 1.

IMPROVEMENT OF HARBOR OF NORFOLK AND ITS APPROACHES, VIRGINIA.

In 1877, previous to commencing the present improvement, the harbor of Norfolk was obstructed by shoals at the mouths of the Eastern and Southern branches, the shoal in the Eastern Branch being about one-third of a mile long, with a depth at low water of 15 to 16 feet, and the shoal in the Southern Branch being short and with a depth at low water of 22 to 23 feet. The approaches to the harbor were obstructed by shoals at Sewalls Point 3 miles long, with a depth at low water of 20 feet, and at the mouth of the Western Branch 1 mile long, with a depth at low water of 19 feet. The depths on these shoals and the widths of the channels, particularly in the inner harbor, where encroached upon by Portsmouth and Berkley flats, were insufficient for the requirements of the port.

The plan of improvement adopted in 1878 was to deepen and widen the channels at the mouth of the Southern Branch and along Portsmouth and Berkley flats, in the harbor proper, and to improve the approaches to the harbor by dredging a channel 500 feet wide and 25 feet deep at ordinary low water through the shoals at Sewalls Point and at the mouth of the Western Branch.

The revised project of 1885 was as follows: (1) To dredge a channel not less than 500 feet wide and 25 feet deep at ordinary low water, from the deep water in Hampton Roads to Norfolk and the U. S. navy-yard on the Southern Branch, and also to dredge a channel in the Eastern Branch not less than 22 feet deep at ordinary low water, with a width of 700 feet at its mouth and of not less than 300 feet at the Norfolk and Western Railroad bridge; (2) to ultimately dredge the entire area bounded by lines parallel to and 75 feet from the port warden lines to a depth not less than 25 feet from Fort Norfolk to the U. S. navy-yard, and not less that 22 feet from the mouth of the Eastern Branch to Campostella bridge, and to build a bulkhead at Berkley Flats.

To the project of 1885 there was added in 1890, under the authority of the river and harbor act of September 19, 1890, the dredging of an anchorage at the mouth of the Western Branch, with a depth of not less than 25 feet at ordinary low water, at an estimated cost of $150,000, which amount was added to the original estimate.

With slight modifications, all operations have been conducted in accordance with the adopted project.

The amount expended on this improvement to June 30, 1893, was $743,611.07, from which resulted a channel not less than 500 feet wide and 25 feet deep at ordinary low water from Hampton Roads to Norfolk Harbor, a channel of the same depth, and from 400 feet to 650 wide in the Southern Branch to the U. S. navy-yard, and a channel not less than 22 feet deep at ordinary low water and from 500 feet to 1,000 feet wide in the Eastern Branch to the Norfolk and Western Railroad bridge.

The channels thus dredged were in good condition, with the exception of the bars at Sewalls Point and Lamberts Point. Examinations made in August, 1893, show shoal spots having from 23½ to 24 feet on the former and considerable shoaling on the eastern side of the dredged channels through the latter.

One hundred and fifty thousand dollars were appropriated for this improvement by act of July 13, 1892. The approved project for the expenditure of this appropriation included the dredging of the shoals and flats in the inner harbor and the continuation of the dredging of the anchorage at the mouth of the Western Branch. Proposals were advertised for, and on October 6, 1892, a contract was entered into with the Morris & Cumings Dredging Company of New York, to do the required dredging, about 1,000,000 cubic yards, at 13$\frac{4}{9}$ cents per cubic yard, scow measurement, the contract to be completed by December 31, 1893. The material is mud, with some sand, clay, and oyster shells, and it is redeposited on Willoughby Bank, in Hampton Roads, to the eastward of the Ripraps, the tow varying from 11 to 15 miles.

Dredging under this contract was commenced in November, 1892, and by June 30, 1893, 917,170 cubic yards of material had been removed and redeposited in accordance with the terms of the contract. During the past fiscal year 56,131 cubic yards of material were removed from the anchorage at the mouth of the Western Branch, producing 2½ acres of the proposed anchorage, with a depth not less than 25 feet at ordinary low water, excepting over a number of old wrecks which were uncovered by the dredging and have not yet been removed. As a result of the operations at the mouth of the Western Branch, 58½ acres of the proposed anchorage have been dredged to the required depth, and 17 acres that required no dredging have been made available.

The contract with the Morris & Cumings Dredging Company was completed July 31, 1893. The total amount of material removed under this contract was 973,301 cubic yards.

During the fiscal year ending June 30, 1894, there was expended on this improvement $38,416.74, applied to payments on contracts, repairs to plant, office and operating expenses, etc.

APPROPRIATIONS.

August 14, 1876	$35,000	August 5, 1886	$50,000
June 18, 1878	50,000	August 11, 1888	50,000
March 3, 1879	75,000	September 19, 1890	150,000
June 14, 1880	50,000	July 13, 1892	150,000
March 3, 1881	75,000		
August 2, 1882	75,000	Total	785,000
July 5, 1884	25,000		

Money statement.

July 1, 1893, balance unexpended	$41,456.43
June 30, 1894, amount expended during fiscal year	38,416.74
July 1, 1894, balance unexpended	3,039.69

Amount (estimated) required for completion of existing project	256,744.56
Amount that can be profitably expended in fiscal year ending June 30, 1896	256,744.56
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

OFFICE OF THE COLLECTOR OF CUSTOMS,
Port of Norfolk, Va., June 5, 1894.

SIR: I beg to acknowledge receipt of your letter of 26th ultimo. I inclose herewith the statistics you request.

Very respectfully,

L. H. SHIELDS,
Collector,
By T. W. BATTLE, JR.,
Special Deputy Collector.

Lieut. EDWARD BURR,
Corps of Engineers, U. S. A.

Imports and exports.

Articles.	Quantity.	Value.
IMPORTS.		
Nitrate of soda		$30,352
Nitrate of potash		17,713
Kainit		22,144
Fruit		26,617
Sundries		13,131
Total		109,957
EXPORTS.		
Cotton ... bales	171,185	6,000,305
Coal ... tons	144,750	496,994
Flour ... barrels	113,272	519,229
Staves		215,842
Bark		15,950
Leaf tobacco ... pounds	11,648,925	502,008
Cotton-seed meal ... bushels	12,506,700	220,915
Lard ... pounds	1,537,250	183,335
Logs		678,279
Corn ... bushels	441,732	267,594
Wheat ... do	77,432	49,266
Miscellaneous		1,537,839
Total		10,696,556

Navigation.

Direction.	Cleared.		Entered.	
	No.	*Tons.*	*No.*	*Tons.*
Foreign	491	675,978	72	73,316
Coastwise	1,321	1,466,119	1,569	1,782,437
Total	1,812	2,142,097	1,641	1,855,753

LETTER OF MR. NORMAN BELL, SUPERINTENDENT AND SECRETARY, NORFOLK AND PORTSMOUTH COTTON EXCHANGE.

NORFOLK, VA., *June 11, 1894.*

DEAR SIR: In response to your courteous request, I herewith submit statement of the receipts and shipments of cotton for twelve months ending December 31, 1893.

	Bales.
Total receipts of cotton at Norfolk, twelve months ending December 31, 1893	463,993
Stock on hand December 31, 1892	48,478
Exported:	
Great Britain and Europe	177,491
Coastwise shipments, overland and inland	246,796
Total shipments	424,287
Stock on hand December 31, 1893	88,184
Total	512,471

On the basis of $36.50 per bale, the value of the total receipts amount to $16,935,745. Allowing 485 pounds to the bale, the total shipments amount to tons, 102,858.

I remain, dear sir, yours, very truly,

NORMAN BELL,
Superintendent and Secretary.

Lieut. EDWARD BURR,
Corps of Engineers, U. S. A.

Exports of coal from Lamberts Point piers at Norfolk, Va., as cleared by William Lamb & Co., agents, from January 1, 1893, to December 31, 1893.

	Tons.
Foreign	160, 657
Coastwise	1, 613, 383½
Total	1, 774, 040½

Vessels engaged in the movement of this coal for the year 1893.

Steamships	491
Ocean tugs and barges	753
Schooners	701
Total	1, 945

Value of exports and imports and number and tonnage of vessels entered at and cleared from the port of Norfolk, Va.

Year ending Jan. 1—	Foreign vessels.				Coastwise vessels.				Exports.	Imports.
	Entered.		Cleared.		Entered.		Cleared.			
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*		
1883	64	29, 572	135	112, 529	1314	1, 248, 461	818	1, 099, 266	$18, 201, 759	$167, 157
1884	96	69, 421	156	110, 450	1257	1, 003, 920	880	996, 062	12, 351, 672	223, 676
1885	66	70, 711	127	102, 821	1330	1, 078, 484	1450	1, 275, 477	14, 797, 046	128, 372
1886	82	67, 168	159	141, 913	1398	1, 215, 398	1555	1, 334, 557	11, 646, 907	127, 391
1887	73	73, 896	208	207, 428	1432	1, 261, 365	1719	1, 432, 016	14, 393, 337	99, 958
1888	66	59, 805	212	234, 644	1314	1, 360, 633	1474	1, 354, 620	12, 381, 122	99, 584
1889	51	64, 975	227	256, 351	1328	1, 386, 573	1402	1, 290, 013	13, 865, 586	176, 253
1890	70	80, 887	288	335, 021	996	1, 265, 470	1302	1, 230, 189	12, 828, 641	166, 958
1891	81	83, 341	397	463, 216	1196	1, 140, 625	1504	1, 546, 235	15, 096, 634	94, 489
1892	94	116, 926	499	672, 107	1582	2, 042, 257	1827	1, 958, 718	15, 269, 094	58, 290
1893	56	65, 295	528	696, 217	1594	1, 419, 176	1391	1, 373, 048	8, 382, 412	37, 981
1894	72	73, 316	491	675, 978	1569	1, 782, 437	1321	1, 466, 119	10, 696, 556	109, 957

Approximate amount of freight of all kinds shipped and received by water.

	Tons.		Tons.
1888	1, 914, 506	1891	2, 931, 751
1889	2, 243, 087	1892	3, 427, 189
1890	2, 384, 841	1893	3, 584, 727

K 2.

IMPROVEMENT OF APPROACH TO NORFOLK HARBOR AND THE UNITED STATES NAVY-YARD AT NORFOLK BETWEEN LAMBERTS POINT AND FORT NORFOLK, VIRGINIA.

In its original condition this portion of the approach to Norfolk Harbor and the U. S. (Norfolk) navy-yard was obstructed by a shoal in the mouth of the western branch about 1 mile long, with a depth of 19 feet at ordinary low water.

The project of 1878 was to dredge through this shoal a channel 500 feet wide with a depth of not less than 25 feet at ordinary low water.

The revised project of 1886 is (1) to secure a channel, not less than 500 feet wide and 25 feet deep at ordinary low water, from Lamberts Point to Fort Norfolk by the construction of a dike and by dredging, and (2) to ultimately widen this channel to within 75 feet of a straight line drawn from Fort Norfolk to the deep water off Lamberts Point, 6,800 feet of which is the proposed warden line, making a channel at least 700 feet wide.

The amount expended on this improvement between July 5, 1884, and June 30, 1893, was $197,593.75, from which resulted a channel between Lamberts Point and Fort Norfolk 700 feet wide and 25 feet deep at ordinary low water, and a channel of the same depth and 600 feet wide from deep water off Lamberts point to the port warden line.

The desired channel was secured in July, 1889, and the project of 1886 completed, with the exception of the dike.

Since that date no dredging has been done. The survey of 1889 and examinations made in April, 1890, and May, 1891, did not show any shoaling of the dredged channel. A survey made in May, 1892, showed a shoaling on the eastern side of the channel, thought not to be due to natural causes. A resurvey made in August, 1893, shows a further shoaling, and partially confirms this view. It is not thought that the proposed dike will be necessary for the maintenance of this channel. To maintain the projected depth, redredging of a portion of the channel will soon be necessary, but it can be provided for out of the funds for improving harbor at Norfolk and its approaches, Virginia. The amount estimated for the construction of this dike could be more advantageously expended in removing the shoal in front of and below the piers at Lamberts Point, on the east side of the channel.

There were no expenditures for this improvement during the fiscal year ending June 30, 1894, and no further appropriations will be required for this project at present.

For commercial statistics see report on the improvement of the harbor of Norfolk and its approaches, Virginia.

APPROPRIATIONS.

July 5, 1884	$50,000
August 5, 1886	137,500
August 11, 1888	10,000
Total	197,500

K 3.

IMPROVEMENT OF NANSEMOND RIVER, VIRGINIA.

This river is one of the important tributaries of Hampton Roads, Virginia, and is navigable at high water for vessels drawing 11 feet as far as the city of Suffolk, 16 miles from its mouth.

Five railroads, two of which terminate at this place, put this city in communication with the South and West, and two lines of steamers run between it and Norfolk and Baltimore.

In 1872, before any improvement was undertaken, the navigable channel of the Nansemond River was 5 feet deep at low water, and was much obstructed by wrecks, snags, etc.

Between 1873 and 1878 the Government dredged a channel, wherever necessary, 8 feet deep at low water from Suffolk to Hampton Roads, at a cost of $37,000. This depth not proving sufficient to meet the demands of its growing commerce, in obedience to the requirements of the river and harbor act of August 5, 1886, an examination and survey of the river were made to determine what other improvement was necessary.

The plan of improvement then proposed and since adopted is to secure a channel not less than 100 feet wide at bottom, 12 feet deep at mean low water, from the head of navigation to the mouth of Western Branch, 5.37 miles, including a turning basin 200 feet square 300 feet below Suffolk bridge, by dredging and by the construction of spur dikes and training walls, and a channel of like depth from the mouth of the Western Branch to deep water at Town Point, 250 feet wide at bottom at its upper end and gradually increasing to at least 400 feet at its lower end, etc., the total estimated cost being, in round numbers, $152,000.

The amount expended on the present project to June 30, 1893, was $29,968.72. This amount has been applied to dredging a channel 80 feet wide and not less than 12 feet deep at mean low water through Suffolk Shoal and 5 other shoals between Suffolk and a point 3½ miles below, these having been the most troublesome of the shoals between Suffolk and the mouth of the Western Branch. A survey made in September, 1893, showed the dredged channels to be generally in good condition, and also showed other shoals having on them less than the projected low-water depth. They will require dredging to obtain the 12 feet depth, and this work should be done before the permanent improvement of the river by dikes and training walls is commenced.

There was expended on this improvement during the fiscal year ending June 30, 1894, $25.50, applied to office and operating expenses, etc.

APPROPRIATIONS.

March 3, 1873	$15,000	August 11, 1888	$10,000
March 23, 1874	10,000	September 19, 1890	10,000
March 3, 1875	5,000	July 13, 1892	10,000
March 14, 1876	5,000		
June 18, 1878	2,000	Total	67,000

Money statement.

July 1, 1893, balance unexpended	$31.28
June 30, 1894, amount expended during fiscal year	25.50
July 1, 1894, balance unexpended	5.78
Amount (estimated) required for completion of existing project	122,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Approximate amount of freight of all kinds received and shipped by water.

	Tons.
1888	109,900
1890	217,738
1891	78,572
1892	133,723
1893	59,473

Full statement could not be gotten for 1893.

K 4.

IMPROVEMENT OF CHICKAHOMINY RIVER, VIRGINIA.

This river is one of the principal tributaries of the James River, and is navigable at high water for vessels drawing 12 feet to Binn Bar, 2½ miles below Windsor Shades. The latter place is the head of navigation, and is 25 miles from the mouth of the river.

Previous to any improvement the channel from Binn Bar to Windsor Shades was obstructed by several shoals with a depth of 4 to 5 feet at low water, and the entrance to the river was obstructed by a bar.

The present project of improvement is to dredge a channel from 100 to 150 feet wide and not less than 8 feet deep at low water through the shoals near the head of navigation, and a channel 200 feet wide and 14 to 15 feet deep at low water through the bar at the entrance. The rise of the tide is about 3 feet.

The amount expended on the present project to June 30, 1893, was $23,827.71. The channel through the bar at the entrance to the river has been dredged to the projected dimensions. An examination made in January, 1891, of the work hitherto done showed that very little shoaling had taken place in the channels dredged since 1878, the worst shoals being near Old Fort. These shoals and those between Binn Bar and Windsor Shades have since been dredged to a depth not less than 8 feet at low water and to a width of 60 feet, excepting a part of Windsor Shades Bar, where the width is only 40 feet.

Five thousand dollars was appropriated for this improvement by act of July 13, 1892. A contract was entered into with Chester T. Caler, of Norfolk, Va., on March 18, 1893, to do the required dredging at 23 cents per cubic yard for material deposited on shore and 12 cents per cubic yard for material deposited by dumping. Work under this contract was to have been commenced on or before March 1, 1894, and completed by April 30, 1894. The contractor failed to commence operations previous to the expiration of his contract time, and upon his application an extension of time of sixty days was granted him. Dredging was commenced June 9, 1894, on Windsor Shades Bar, and 17,446 cubic yards of material removed and redeposited from scows by dumping. A channel from 90 feet to 100 feet wide, 2,250 feet long, and not less than 8 feet deep at low water was dredged through Windsor Shades Bar. The contract had not been completed at the end of the fiscal year, and an application for a further extension of thirty days has been made.

The expenditures on this improvement during the fiscal year ending June 30, 1894, were $2.20. The funds now appropriated will complete this improvement according to the present project and furnish such facilities for the transportation interests on this stream as are at present necessary. No further appropriation is necessary.

APPROPRIATIONS.

June 13, 1878	$5,000
March 3, 1879	1,000
June 14, 1880	2,000
March 3, 1881	2,000
August 2, 1882	5,000
August 5, 1886	4,000
August 11, 1888	$2,500
September 19, 1890	2,500
July 13, 1892	5,000
Total	29,000

Money statement.

July 1, 1893, balance unexpended		$5,172.29
June 30, 1894, amount expended during fiscal year		2.20
July 1, 1894, balance unexpended		5,170.09
July 1, 1894, outstanding liabilities	$2,267.98	
July 1, 1894, amount covered by uncompleted contracts	2,432.02	
		4,700.00
July 1, 1894, balance available		470.09

COMMERCIAL STATISTICS.

WINDSOR SHADES, *June 13, 1894.*

SIR: Owing to the financial condition of the country the trade has not been as good as heretofore.

No new lines on the river.

Yours, truly,

L. F. BARNES.

Lieut. EDWARD BURR,
Corps of Engineers, U. S. A.

Shipments and receipts: Lumber, railroad ties, merchandise, vegetables, etc., $320,000.

K 5.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

This river is one of the principal tributaries of the James River, into which it empties at City Point, Va. It is navigable as far as the city of Petersburg, Va., abut 11 miles from its mouth, and before improvement had a tortuous channel, obstructed by shoals, over which there was about 3½ feet of water at low tide.

The project for this improvement was adopted in 1870, and provided for a channel 60 feet wide at the bottom and 12 feet deep at ordinary high water. As subsequently modified, the project is to provide a channel from Petersburg to natural deep water at Point of Rocks 80 feet wide at bottom and 12 feet deep at ordinary high water by dredging, by constructing regulating, and contracting works, and by making a cut-off called Puddledock Cut. With slight modifications of details all operations have been conducted in accordance with this project.

This stream is subject irregularly to freshets, by which large quantities of sand are brought down and deposited in the navigable portion of the river. The currents of ordinary stages of the river have not sufficient power to remove the shoals thus formed, and a sum of $10,000 per annum is estimated as required for their removal by dredging and for repairing damages to contracting and regulating works by freshets and deterioration. The sums appropriated for this improvement have for many years been but little in excess of the amount required for the repairs to the channel and the works already constructed. The completion of the permanent improvement of the river has consequently dragged beyond all reason, and the apparent cost of the improvement has been much in excess of the original estimate, while the actual amount expended in accordance with these estimates has been but a small proportion of the total expenditures.

The amount expended by the United States on this improvement to June 30, 1893, was $416,643.63.

By 1875 a channel 60 feet wide and 12 feet deep at ordinary high water had been secured from Petersburg to Point of Rocks by dredging such shoals as required it and by making a cut off called Puddledock Cut. This channel was subsequently increased in width to 80 feet, and has been maintained with a depth of 11 to 12 feet as constantly as possible by redredging shoals formed by freshets and by constructing contracting and regulating works.

Such shoals as were troublesome had been dredged during the summer of 1892. By June, 1893, the dredged shoals had partially reformed, and a further shoaling necessitated the resumption of dredging operations in April, 1894, with the balance of funds on hand.

The shoals which give trouble are above and below the mouth of the old South Channel, at the Closure Dike and in Magazine Bend. The latter can only be removed by a radical rectification of the channel, if at all. On account of its relatively great cost this method has not been deemed advisable of adoption, and resort to temporary improvement by dredging is continued. It is believed that no difficulty would be found in producing the required depth above and below the mouth of the old South Channel by works of permanent improvement were funds appropriated in such amounts as to permit of their extension to this portion of the river. The dam built during the previous year behind the Closure Dike appears to be having the desired effect upon the shoal at that point, and it is hoped that after the present season no further dredging will be required on this shoal.

Dredging was commenced April 23, 1894, by hired labor, the hire of the dredge belonging to the city of Petersburg and the use of Government plant. Below the mouth of the South Channel three cuts were dredged for a channnl width of 60 feet and a length of 950 feet, 10,300 cubic yards of material being removed. In Magazine Bend two cuts were dredged for a channel width of 40 feet and a length of 940 feet, 4,900 cubic yards of material being removed. At the Closure Dike one cut was dredged for a channel width of 20 feet and a length of 455 feet, 1,950 cubic yards of material being removed. The work at the latter place was in progress at the close of the year. All dredging was to 12 feet below mean high water. Seventeen thousand one hundred and fifty cubic yards of material were dredged during the year, at an average cost of 18 cents per cubic yard, including the cost of placing 6,850 cubic yards behind the Closure Dike Dam to strengthen it.

The expenditures on this improvement during the fiscal year ending June 30, 1894, were $5,278.31, and were applied to the work mentioned above and to office and incidental expenses, etc.

In the estimates for the fiscal year ending June 30, 1896, there is included an item of $10,000 for maintenance and repairs, in accordance with the estimates of the board of engineers of 1870 and the revised estimates of June 8, 1893.

APPROPRIATIONS.

March 3, 1871	$50,000	March 3, 1881	$20,000
June 10, 1872	40,000	August 2, 1882	35,000
March 3, 1873	30,000	July 5, 1884	25,000
June 23, 1874	30,000	August 5, 1886	18,750
March 3, 1875	30,000	August 11, 1888	15,000
August 14, 1876	30,000	September 19, 1890	15,000
June 18, 1878	30,000	July 13, 1892	15,080
March 3, 1879	20,000		
June 14, 1880	20,000	Total	423,830

Money statement.

July 1, 1893, balance unexpended	$7,280.87
June 30, 1894, amount expended during fiscal year	5,278.31
July 1, 1894, balance unexpended	2,002.56
July 1, 1894, outstanding liabilities	480.00
July 1, 1894, balance available	1,522.56
Amount (estimated) required for completion of existing project	48,090.00
For maintenance and repairs during fiscal year ending June 30, 1896	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	58,090.00

Submitted in compliance with requirments of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

[Furnished by Mr. W. E. Morrison, port warden.]

Year ending—	No.	Tonnage.	Value of freights.		
			Shipped.	Received.	Total.
July 1—					
1881	645	35,967	$74,724	$412,642	$487,366
1882	917	43,961	79,154	519,209	598,363
1883	980	46,070	181,763	569,876	751,639
1884	924	46,050	196,458	612,472	808,930
1885	893	40,669	230,508	529,786	760,294
1886	953	68,835	192,055	474,250	666,303
1887	836	63,169	104,923	304,425	409,348
1888	599	30,079	143,673	372,112	515,785
1889	595	27,981	132,072	270,031	402,103
January 1—					
1890	598	29,229	184,596	323,256	507,852
1891	621	35,219	425,887	280,254	706,141
1892	627	40,034	313,317	330,786	644,103
July 1, 1893	639	42,058	218,270	227,452	445,722

Approximate amount of freight of all kinds received and shipped by water.

	Tons.
1888	30,626
1889	26,121
1890	21,693
1891	26,275
1892	25,218

Statistics for the year ending July 1, 1894, have been asked for, but have not been received.

K 6.

IMPROVEMENT OF INLAND WATER ROUTE FROM NORFOLK, VIRGINIA, TO ALBEMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

This water route is one of the most important links in the chain of inland water communication along the Atlantic coast. It connects Chesapeake Bay with Albemarle Sound, and is composed of the following bodies of water, viz: Elizabeth River, North Landing River, Currituck Sound, Coanjok Bay, North River, and the Albemarle and Chesapeake Canal. With the exception of the canal all are natural waterways, and previous to the act of September 19, 1890, which contained an item of $10,000 for this route, these waterways had been separately under improvement.

The Elizabeth River, 11.9 miles long, was under improvement between 1873 and 1878. At a cost of $40,180 a channel 60 feet wide and 8 feet at low water was secured.

The North Landing River, 17 miles long, was under improvement between 1879 and 1887. At a cost of $49,777.34 a channel 80 feet wide and 9 feet deep was secured.

Currituck Sound, Coanjok Bay, and North River Bar, 13½ miles, were under improvement between 1879 and 1890. At a cost of $141,656.16 a channel 60 feet wide and 9 feet deep was secured through the sound, and a channel 40 feet wide of the same depth through the bay and over the bar.

Before any improvement was undertaken by the Government there was over this route an indifferent channel 5 to 7 feet deep at low water, the navigation of which was obstructed by overhanging growth, snags, and sharp bends in all the rivers. The project for the improvement was to secure a channel 80 feet wide and 9 feet deep at low water over the entire route, about 58 miles, by dredging, by removing obstructions, and by constructing a dike.

Steady progress is making toward securing the projected channel, and at present the regular steamboat lines running between North Carolina ports and Norfolk and Baltimore employ vessels whose maximum dimensions are: Length, 190 feet; width, 25.2 feet; draft, 8 feet, and tonnage, 421 tons.

The amount expended upon this improvement from the consolidation in 1890 to June 30, 1893, is $9,300.26. Including the expenditures of logging operations in the North Landing River, amounting to $6,379.54, the amount expended to June 30, 1893, upon the separate items noted above is $238,656.88. Including the expenditures on the separate items the amount expended upon the improvement of this route is $247,957.14.

Nine thousand dollars were appropriated for this improvement by act of July 13, 1892. A contract was entered into on March 18, 1893, with Chester T. Caler, of Norfolk, Va., to do the work at 13½ cents per cubic yard for dredging in North River, and 29 cents per cubic yard for dredging on North River Bar. The work was to have been commenced before January 15, 1894, and completed by April 30, 1894. Dredging in North River, North Carolina, was commenced on February 28, 1894, and completed April 16, 1894. Thirty-nine thousand two hundred and seventy-six cubic yards of material and 34 saw logs were removed and redeposited in accordance with the terms of the contract. A channel 80 feet wide and 5,150 feet long was dredged from the southern end of the North Carolina cut of the Albemarle and Chesapeake Canal to a point 2,000 feet southward from Beacon No. 9.

An examination of North River Bar having shown that no dredging was necessary, so much of the contract as applied to dredging that bar was, with the consent of the bondsmen, annulled by a supplemental contract approved May 7, 1894. A written agreement was entered into with the contractor to do such dredging as was required in Currituck Sound, North Carolina, at the same price, 13½ cents per cubic yard, that he received for dredging in North River, North Carolina. Under this agreement 25,724 cubic yards of material were dredged in deepening the channel in Currituck Sound, between beacons No. 5 and No. 6. A channel 70 feet wide and 9 feet deep at low water was dredged for a length of 4,300 feet, beginning at Beacon No. 6. The total amount dredged during the year was 65,000 cubic yards.

The amount expended on this improvement during the fiscal year ending June 30, 1894, was $9,623.23, applied to office expenses, reading tide gauges, payments on contract, etc.

APPROPRIATIONS.

For South Branch, Elizabeth River, Virginia:	
March 3, 1873	$15,000
June 23, 1874	10,000
March 3, 1875	5,000
August 14, 1876	5,000
June 18, 1878	5,000
For North Landing River, Virginia and North Carolina:	
March 3, 1879	25,000
June 14, 1880	15,000
March 3, 1881	7,500
August 2, 1882	8,000
For Currituck Sound, Coanjok Bay, and North River Bar, North Carolina:	
June 18, 1878	$20,000
March 3, 1879	25,000
June 14, 1880	25,000
March 3, 1881	30,000
August 2, 1882	20,000
July 5, 1884	5,000
August 5, 1886	10,000
August 11, 1888	7,500
For inland water route, etc.:	
September 19, 1890	10,000
July 13, 1892	9,000
Total	257,000

Money statement.

July 1, 1893, balance unexpended	$9,699.74
June 30, 1894, amount expended during fiscal year	9,623.23
July 1, 1894, balance unexpended	76.51
Amount (estimated) required for completion of existing project	49,667.08
Amount that can be profitably expended in fiscal year ending June 30, 1896	49,667.08

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

[From records of Albemarle and Chesapeake Canal Company.]

Number, class, and tonnage of vessels passing through the inland water route, from Norfolk, Va., to Albemarle Sound, North Carolina.

Year ending—	Steamers.	Schooners.	Barges.	Lighters.	Sloops.	Rafts.	Tonnage.
June 30—							
1885	2,976	1,059	633	133	204	181	....
1889	3,271	1,082	549	55	178	244	336,737
1887	3,369	1,216	568	49	181	297	358,111
1888	3,862	1,362	361	44	265	371	435,745
January 1—							
1889	4,065	1,539	683	82	352	352	445,237
1890	4,169	1,699	878	67	446	335	454,950
1891	4,068	1,304	1,000	113	394	350	445,443
1892	4,061	1,817	1,150	62	320	298	467,113
1893	4,026	1,077	1,109	82	281	350	440,319
1894	3,407	1,046	980	127	224	269	414,410

Approximate amount of all kinds of freight passing through this route.

	Tons.
1888	335,758
1889	372,617
1890	403,111
1891	328,609
1892	281,542
1893	296,520

K 7.

IMPROVEMENT OF NORTH LANDING RIVER, VIRGINIA AND NORTH CAROLINA.

This river forms one of the links of the inland water routes from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound, described above.

Before improvement the navigation of this river was obstructed by shoals, over which the depth was 6 feet at low water, by snags, and by sharp bends.

The plan of improvement adopted in 1879 was to secure a channel 80 feet wide and 9 feet deep at low water by dredging shoals and removing bends and obstructions from North Landing bridge to Feraby Island, in Currituck Sound, a distance of 17 miles.

This channel was obtained and the project completed June 30, 1884, at a cost of $49,777.34. Since that time $6,379.54 has been expended on this river in removing sunken logs, which have been detached from passing rafts, making the total expenditures on this improvement since June 30, 1893, $56,156.88.

The river was last cleared of sunken logs in August and September, 1892, these obstructions having by that time become troublesome to navigation.

The method adopted for rafting logs in these waters is very faulty, resulting in a considerable loss of logs to the owners and a material obstruction to navigation on this river and the connecting portions of the inland water route, by decreasing the available navigable depth by at least 1 foot and by remaining a menace to the hulls and propellers of passing vessels. These sunken logs are now the controlling element of the available depth in these streams, and the desirability of doing any further dredging while the rafting business is carried on under the present system is questionable.

There were no expenditures on this improvement during the fiscal year ending June 30, 1894.

The only operations contemplated for the present are the removal of sunken obstructions from time to time. The balance on hand will suffice for this purpose, and no further appropriation is needed.

For commercial statistics, see report on improvement of "Inland water route," etc.

APPROPRIATIONS.

March 3, 1879	$25,000
June 14, 1880	15,000
March 3, 1881	7,500
August 2, 1882	8,000
Total	55,500

Money statement.

July 1, 1893, balance unexpended	$1,512.81
July 1, 1894, balance unexpended	1,512.81

K 8.

REMOVAL OF SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wrecks of schooners Lulu, Edith Berwind, and Mary E. H. G. Dow.—The three-masted schooner *Lulu* went ashore on the Horseshoe, Chesapeake Bay, ENE. 2¼ miles from Thimble Shoal Light. She was built in 1873, at Wattleboro, Me., and her dimensions are: Length, 136 feet; beam, 32 feet; depth, 15 feet; registered tonnage, 451 tons; is built of wood, and when wrecked was laden with coal.

The four-masted schooner *Edith Berwind* went ashore on Nautilus Shoal, Cape Charles, Virginia, 4¾ miles SSW. from Cape Charles Light and 1¼ miles E. of Nautilus Shoal Buoy No. 2. She was built in 1889 at Coopers Point, New Jersey, and her dimensions are: Length, 177 feet; beam, 39 feet; depth, 16 feet; registered tonnage, 815 tons; is built of wood, and when wrecked was laden with phosphate rock.

The four-masted schooner *Mary E. H. G. Dow* went ashore on the Outer Middle Ground, Cape Charles, Virginia, 1 mile SE. of Middle Ground Buoy No. 4. She was built in 1892 at Bath, Me., and her dimensions are: Length, 203 feet; beam, 32 feet; depth, 19 feet; registered tonnage, 1,138 tons; is built of wood, and when wrecked was laden with coal.

These three wrecks were reported as obstructing and endangering navigation, and when it became evident that their owners did not intend to remove them a project for their removal, at a cost (estimated) of $1,500 for the *Lulu*, $3,000 for the *Edith Berwind*, and $2,500 for the *Mary E. H. G. Dow*, was submitted for approval and their removal authorized. The thirty days' notice required by law was published on May 6, 1893, and proposals for removing the three wrecks were opened on June 6, 1893.

A contract was entered into on June 19, 1893, with the lowest bidder, W. H. French, of Norfolk, Va., for their removal, at a cost of $1,500 for the *Lulu*, $1,700 for the *Edith Berwind* and $1,800 for the *Mary E. H. G. Dow*, the work to be commenced by July 1, 1893, and completed by August 31, 1893.

Operations were begun under this contract on July 3, 1893, and completed August 1, 1893.

The total cost of the removal of the three wrecks was $5,181.92, of which $5,000 was for work done under contract and the $181.92 was for inspection, advertising, etc.

APPENDIX L.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA AND SOUTH CAROLINA.

REPORT OF MAJ. W. S. STANTON, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORK.

IMPROVEMENTS.

1. Roanoke River, North Carolina.
2. Pasquotank River, North Carolina.
3. Mackeys Creek, North Carolina.
4. Ocracoke Inlet, North Carolina.
5. Fishing Creek, North Carolina.
6. Pamlico and Tar Rivers, North Carolina.
7. Contentnia Creek, North Carolina.
8. Trent River, North Carolina.
9. Neuse River, North Carolina.
10. Inland waterway between Newbern and Beaufort, N. C.
11. Harbor at Beaufort, N. C.
12. Inland waterway between Beaufort Harbor and New River, N. C.
13. Inland waterway between New River and Swansboro, N. C.
14. New River, North Carolina.
15. North East (Cape Fear) River, North Carolina.
16. Black River, North Carolina.
17. Cape Fear River, above Wilmington, N. C.
18. Cape Fear River, at and below Wilmington, N. C.
19. Lockwoods Folly River, North Carolina.
20. Georgetown Harbor, South Carolina.
21. Winyaw Bay, South Carolina.
22. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 9, 1894.

GENERAL: I have the honor to transmit herewith annual reports for the fiscal year ending June 30, 1894, upon the works of river and harbor improvement under my charge.

Very respectfully, your obedient servant,

W. S. STANTON,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

L 1.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA

The Roanoke flows into the extreme westerly end of Albemarle Sound, a tideless body of fresh water connected by the strait known as Croatan Sound with Pamlico Sound, likewise tideless but of salt water. From the mouth of the Roanoke the distance by these three sounds to the ocean at Ocracoke Inlet, and by Albemarle Sound, North River, Albemarle and Chesapeake Canal, and Elizabeth River to Hampton Roads, is the same—namely, 108 miles. By the former route the controlling depth of water is 7½ feet, which is the greatest depth that can be relied upon in the channel on the inner shoals at Ocracoke Inlet; and if, in accordance with the approved project for the improvement of that channel, the depth be increased from 7½ to 9 feet the controlling depth by the route to the mouth of the Roanoke will be increased only to 8 feet, which is the greatest depth that can be relied upon through Croatan Sound. By the route from Hampton Roads the controlling depth varies from 6 to 7 feet, varying as the direction and force of the wind impels water from or into the canal.

From the mouth of the Roanoke up 67 miles to Indian Highland Bar, extending past the towns of Plymouth, Jamesville, Williamston, and Hamilton, all on its right (southerly) bank, with populations, respectively, of 1,212, 346, 751, and 781, its natural channel at lowest stages very much exceeds the depth of 8 feet, the greatest that may soon be available to vessels in reaching the river from tide water. In the vicinity of Indian Highland Bar the natural depth diminishes from about 15 feet to less than 5 feet, and thence 62 miles to Weldon the channel is a succession of pools separated by bars of sand, gravel, or rock.

The purpose of the improvement was to clear the channel of trees, snags, and war obstructions up 62 miles to Hamilton, the uppermost of the four towns above mentioned, permitting to that town a continuous navigation for 171 miles from tide water, with a controlling depth (from Ocracoke Inlet) of 7½ feet, and to deepen the natural channel through the bars in the 62 miles from Indian Highland Bar to Weldon.

In pursuance of that purpose the project which was adopted in 1872 was to secure, at all seasons of the year, an unobstructed channel with a least width of 50 feet from the mouth 129 miles to Weldon, with a low-water depth of 5 feet for the 67 miles above Hamilton, and to clear the natural channel of snags and artificial obstructions for the 62 miles below Hamilton to the depth requisite for vessels navigating the North Carolina sounds, by removing war obstructions, snags, fallen and overhanging trees, sand bars, and ledges, by dredging, by the construction of training dikes, and by blasting, at an estimated cost, at the high prices of that time, of $269,000.

A more detailed description of the river, and a summary of the work under the foregoing project to June 30, 1893, will be found on pp. 1103–1107 and 1351–1352 of the Annual Reports of the Chief of Engineers, respectively for 1892 and 1893.

During the fiscal year ending June 30, 1894, with three hoisters manned by 27 men, there have been removed from 40.5 miles of channel, extending from the twelfth milepost + ½, a point about 5 miles above Plymouth, to the fifty-second milepost, 10 miles below Hamilton, 1,126 snags, 270 stumps, 347 trees, and 33 logs; and from 11 miles of river, extending from the one hundred and nineteenth milepost, a little below the landing of the State Penitentiary farm, opposite Halifax and 10 miles below Weldon, to the one hundred and eighth milepost, 284 snags, 113 stumps, and 350 trees; and from 17.7 miles of single bank, interspersed along the 34 miles between the eighteenth milepost at Jamesville and the fifty-second milepost, 10 miles below Hamilton, 2,258 stumps, and 7,130 trees were cut and hauled back, and 84 trees trimmed, the aggregate number of obstructions removed from the channel being

1,410 snags, 383 stumps, 697 trees, and 33 logs, besides those removed from the banks.

On March 31, 1894, the clearing of the channel and banks was so far advanced, two hoisters were withdrawn from the river to be towed to the U. S. Engineer depot at Washington, N. C., the smaller of which, the *Conoho*, suitable only for bank trimming and much weakened by decay after long service upon the river, foundered in a storm in Pamlico Sound. The hoister *Pamlico* was left upon the river to remove several bank slides which have occurred between the eightieth and one hundred and nineteenth mileposts (or Palmyra and Hamilton), upon which she is now engaged. This hoister will be maintained in the river for the maintenance of the channel.

By indorsement of May 14, 1890, from the office of the Chief of Engineers, $6,000 were allotted for application to dredging a cut-off 1,100 feet in length at Shad Island Bend, 29½ miles above the mouth of the river, of which about $1,000 were applied in July, 1890, to clearing the site of trees and stumps and in dredging a cut 23 feet wide, 7 feet deep, to about the level of low water, and 150 feet long, when the work was suspended. Its resumption has been long delayed to await the conveyance to the United States of a title to the site, which has been obtained.

March 26, 1894, contract was entered into with the lowest bidder, Chester T. Caler, of Norfolk, Va., and approved March 30, 1894, for dredging to the amount of $5,000, at 16 cents per cubic yard, measured in scow, work to be commenced by October 8, 1894, and to be completed by January 8, 1895. Work has not yet commenced.

The bend is a double one, very sharp, and troublesome to the larger steamers.

There is now from Hamilton up to a point 1¼ miles below Weldon the depth of 5 feet prescribed in the project, except upon a sand bar about 150 feet long at Spring Gut, 21 miles above Hamilton, and upon a sand bar about 1,600 feet long, with a rocky point about 100 feet across at Halifax, 57 miles above Hamilton. At these localities an increase of depth of not more than 1 foot is necessary to obtain 5 feet at low water, assumed at the zero of the Weldon gauge, which was the lowest recorded stage of water from February 1, 1875, to June 30, 1876, from May to December 30, 1889, and during 1891, 1892, and 1893, a period of four years and eleven months.

On a sand bar 800 feet in length, about 1¼ miles below Weldon, the depth is somewhat less, and on a ledge of rock extending from the old Weldon Ferry 2,850 feet up to the old Weldon Landing the depth is about 1 foot less than that prescribed in the project.

At Looking Glass Bar, which is of sand and 41 miles above Hamilton, the channel is of the prescribed depth, but only from 30 to 70 feet wide.

Except the bank slides between the eightieth and one hundred and nineteenth mileposts, upon which the hoister is now engaged, the channel and banks are well cleared and the river is in good navigable condition.

The commercial statistics furnished by the agents of the steamboats plying on the river and by shippers, aggregated for the calendar years 1891, 1892, and 1893, respectively, 376,181 tons, 42,039 tons, and 121,024 tons. These three amounts include, respectively, 326,289 tons, 17,166 tons, and 105,411 tons of lumber and lumber products, some of which was carried in bottoms, while an unknown proportion of it was logs in rafts.

A very considerable part of this great fluctuation in lumber and its products can not be real, but must be ascribable to indifference to accuracy on the part of some of the shippers from whom only these statistics can be obtained.

Deducting all lumber and lumber products, the proportion of which that was carried in bottoms is unknown, there remains for all other freight carried in bottoms on the Roanoke River during the calendar years 1891, 1892, and 1893, respectively, 49,892 tons, 24,873 tons, and 15,613 tons.

During the fiscal years ended June 30, 1892, 1893, and 1894, the number and total tonnage of steamers that plied upon the river was as follows: 1892, 5, aggregating 713.96 tons; 1893, 8, aggregating 1,163.34 tons; 1894, 8, aggregating 914.42 tons.

Of the 8 steamers running on the river during this last fiscal year, 2 of 29 tons and 76 tons, ascend it only 7 miles to Plymouth; 2 of 100 tons and 210 tons, only 37 miles to Williamston; 1 of 291 tons 62 miles to Hamilton, while only 2 steamers, the *Lucy* of 76 and the *Ranger* of 69 tons, and a steam barge of 102 tons, navigate any part of the river above Indian Highland Bar, where the channel depth on the bars has been artificially increased, the *Lucy* running weekly to Edwards Ferry, 35 miles above Indian Highland Bar, and the *Ranger* running irregularly to the vicinity of Halifax, 17 miles higher, the barge running irregularly to Palmyra, 12 miles above Indian Highland Bar.

The entire part of the river 129 miles long embraced in the project of improvement is paralleled by railroads, at a distance from it nowhere exceeding 7 miles, which touch it at four points, Plymouth, Jamesville, Williamston, and Halifax, and cross it at two others, at Weldon and 38 miles below it. From these crossings the distance to Norfolk by railroad is respectively 80 and 79 miles, while by water it is 238 miles and 200 miles, respectively.

While the railroads seem to carry a large part of the commerce of the region of the Roanoke, shippers regard the maintenance of a navigable channel very beneficial in controlling freight rates by rail.

The balance now available is adequate to maintain the channel in good condition until June 30, 1896.

The river is in the collection district of Edenton, N. C.

Money statement.

July 1, 1893, balance unexpended		$44,829.14
June 30, 1894, amount expended during fiscal year		13,774.14
July 1, 1894, balance unexpended		31,055.00
July 1, 1894, outstanding liabilities	$398.18	
July 1, 1894, amount covered by uncompleted contracts	5,000.00	
		5,398.18
July 1, 1894, balance available		25,656.82

Abstract of proposals for dredging in Roanoke River, North Carolina, received in response to advertisement dated February 10, 1894, and opened at 11 o'clock a. m., March 10, 1894, by Maj. W. S. Stanton, Corps of Engineers, U. S. Army.

No.	Name and address of bidder.	Price bid (per cubic yard, scow measure).
		Cents.
1	Chester T. Caler, Norfolk, Va	16
2	Virginia Dredging Co., Richmond, Va.*	24
3	B. F. Hipple, Philadelphia, Pa	$27\frac{33}{100}$
4	G. K. Baker, Berkley, Va	$17\frac{7}{10}$

*Contingent upon dredging in waterway between Beaufort Harbor, and New River, North Carolina. Bid No. 2 is informal, inasmuch as there is no guaranty and that the evidence of the president's authority to execute the same is not furnished, nor is the seal of the company attached.

Recommended that award be made to No. 1, Chester T. Caler.

COMMERCIAL STATISTICS.

List of steamers navigating the Roanoke River, North Carolina, during the fiscal year ending June 30, 1894.

Name.	Net tonnage.	From—	To—	Number of trips.
Plymouth	210.15	Williamston	Edenton	Daily.
Lucy	76.36	Edwards Ferry	Norfolk	Weekly.
Bertie	35.47	Plymouth	Windsor	Daily.
Susie Hitch	291.52	Hamilton	Montrose	Weekly.
Belle of Virginia	29.23	Plymouth	Norfolk	Do.
Harry	100.46	Williamston	....do	Do.
Ranger	69.24	Above Halifax	....do	Irregular.
Ox	101.99	Palmyra	....do	Do.
Total	914.42			

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	1,909	Peanuts	1,124
Cotton seed	83	Lumber	97,290
Grains	395	Shingles	8,127
Vegetables, including truck	158	Fertilizers	2,449
Cattle	11	Machinery	20
Horses	8	General merchandise	8,855
Fish	278		
Oysters	65	Total	121,024
Tar	252		

Number of passengers carried		10,284
Increase since last year	tons..	78,985
Transportation lines established		None.
All articles carried in bottoms, other than lumber	tons..	23,734
Lumber, embracing such as was carried in bottoms and some carried as logs in rafts	tons..	97,290
Total, as above	do..	121,024

Freight transported.

Calendar year ending December 31—	Tons.
1870	150.000
1890	182,700
1891	376,181
1892	42,039

Roanoke River, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate
March 3, 1871	$20,000	$20,000	July 5, 1884	$3,000	$53,000
June 10, 1872	10,000	30,000	August 5, 1886	20,000	73,000
March 3, 1873	10,000	40,000	August 11, 1888	40,000	113,000
June 23, 1874	5,000	45,000	September 19, 1890	25,000	138,000
August 2, 1882	5,000	50,000	July 13, 1892	50,000	188,000

EXPENDED.

To June 30—	Amount.	To June 30—	Amount.
1871	$220.75	1885	$49,699.76
1872	9,002.93	1886	49,699.76
1873	15,926.59	1887	58,978.34
1874	29,665.61	1888	70,435.72
1875	34,413.88	1889	81,456.81
1876	39,717.37	1890	102,034.82
1877	44,818.02	1891	119,040.37
1878	45,000.00	1892	131,120.65
1883	46,274.81	1893	144,471.97
1884	49,022.81		

L 2.

IMPROVEMENT OF PASQUOTANK RIVER, NORTH CAROLINA.

The Pasquotank flows into Albemarle Sound and is joined about 30 miles above its mouth by the Dismal Swamp Canal, making, with the Elizabeth River, one of the two continuous inland water routes from the sound to tide water at Norfolk.

While 6 or 7 feet, dependent upon the force and direction of the wind, can be carried through the Albemarle and Chesapeake Canal, the artificial part of the other route, only 3 feet can be carried through the Dismal Swamp Canal, which was constructed with a depth of 5½ feet, but has shoaled in places.

The project, as modified August 3, 1892, and now in force, is to clear the river channel below the lower junction of the canal of obstructions for small craft of the draft that can be carried through the canal.

A description of the river, a brief summary of the history of the canal, which now belongs entirely to a corporation, and of the Government's former proprietary interest therein; the project of 1889 for the improvement of the river, its modification August 3, 1892, and the work done thereunder, both prior and subsequent to the modification, to June 30, 1893, will be found, with map, at pp. 1354–1357 of the Annual Report of the Chief of Engineers for 1893.

No work has been done during the fiscal year ended June 30, 1894, the channel below the entrance to the canal being in good condition for small craft of the draft that can pass through the latter.

There is reported to be carried through the canal about 30,000 tons annually.

A very considerable amount of commerce is carried by steamboats from Newbern, through Pamlico, Croatan, and across Albemarle sounds, thence 17 miles up the Pasquotank River to Elizabeth City, whence it is shipped by the Norfolk and Southern Railroad 46 miles to Norfolk, but the project does not embrace, nor is there necessity for, any improvement of that part of the river, hence its commercial statistics have not been collected.

The balance available, $1,494.57, is adequate to maintain until June 30, 1896, the channel up to the canal for boats of the draft that can pass through the latter.

The river is in the collection district of Elizabeth City, N. C.

Money statement.

July 1, 1893, balance unexpended	$1,508.83
June 30, 1894, amount expended during fiscal year	9.98
July 1, 1894, balance unexpended	1,498.85
July 1, 1894, outstanding liabilities	57.50
July 1, 1894, balance available	1,441.35

Pasquotank River, North Carolina.

Appropriated—	
March 2, 1829	$80.00
September 19, 1890	3,000.00
July 13, 1892	3,000.00
Expended fiscal year ending—	
June 30, 1829	*47.25
June 30, 1891	2,340.28
June 30, 1892	75.87
June 30, 1893	4,497.17

L 3.

IMPROVEMENT OF MACKEYS CREEK, NORTH CAROLINA.

The Norfolk and Southern Railroad, extending from Norfolk 70 miles to Edenton, N. C., at the head of Edenton Bay, on the north shore of Albemarle Sound, has a section 39 miles long extending from Mackeys Creek on the south shore of the sound into the peninsula lying between Albemarle and Pamlico Sounds, and its cars, loaded principally with lumber and shingles, with some other freight and some passengers, are towed on barges 8 miles across the sound between the two sections of road.

The project of 1889 was to dredge a channel 9 feet deep, 100 feet wide, and about 2,100 feet long through the bar at the mouth of the creek, which is described at pp. 1113, 1114 of the Annual Report of the Chief of Engineers for 1892, where, and also on pp. 1357, 1358 of the Annual Report of the Chief of Engineers for 1893, will be found the history of the work under the project from its commencement February 13, 1892, until the completion of the project July 12, 1892, when a channel 2,200 feet long, 140 feet wide, and 9 feet deep was obtained through the bar.

A survey of the channel in June, 1893, failed to reveal any shoaling in the channel eleven months after its completion, and no work has been done for its maintenance during the fiscal year ending June 30, 1894.

This creek is in the collection district of Edenton, N. C.

Money statement.

July 1, 1893, balance unexpended	$603.55
June 30, 1894, amount expended during fiscal year	139.06
July 1, 1894, balance unexpended	464.49
July 1, 1894, outstanding liabilities	50.00
July 1, 1894, balance available	414.49

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[*] Balance of $32.75 turned over to surplus fund.

COMMERCIAL STATISTICS.

The commerce for the year ending December, 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	668	Peanuts	201
Cotton seed	67	Lumber	31, 214
Rice	40	Shingles	4, 838
Grains	24	Fertilizers	417
Vegetables (including truck)	1, 928	General merchandise	7, 134
Cattle	22		
Fish	114	Total	46, 667

Number of passengers carried, 5,180. Increase since last year, 16,444 tons; transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1890	32, 410
1891	33, 922
1892	30, 223

Mackeys Creek, North Carolina.

Appropriated September 19, 1890	$15, 000. 00
Expended to June 30—	
1891	359. 48
1892	12, 061. 03
1893	14, 501. 04

L 4.

IMPROVEMENT OF OCRACOKE INLET, NORTH CAROLINA.

The project of 1889 was to dredge a channel 300 feet wide through the shoals which, immediately within this inlet, are interposed between it and the requisite depth in Pamlico Sound, at an estimated cost, if 10 feet deep, of $100,000; if 13 feet deep, of $190,000; or if 15 feet deep, of $280,000, and to protect the channel so dredged by such training walls or protecting dikes as may possibly prove necessary, at an estimated additional cost of $320,000.

The controlling depth at mean low water in the channel navigated over the inner shoals was in 1891, as in 1894, 7½ feet, and the depth in the channel on the bar at the ocean entrance to the inlet was 14 feet in 1891 and 1892, but is 12 feet in 1894.

April 2, 1892, the Chief of Engineers directed, upon the recommendation of the Division Engineer, that the District Engineer submit "a special report on this subject with estimates of the cost of obtaining and maintaining depths of 10, 12, and 14 or 15 feet at low water through the inner shoals," with his "views as to the present and prospective requirements of the situation, taking into account the ruling depths of the rivers whose commerce would probably be affected by the improvement proposed and the navigation in and through Pamlico Sound."

A supplemental survey of the shoals, essential to the preparation of the detailed report so required, was made in September and October, 1892, with the important exception of the necessary current observations, which were prevented by the weather, and May 15, 1893, the report was submitted, embodying the result of careful investigation of the present and prospective requirements of the situation, of the prospect of maintenance based upon the results of the application of $133,732.40 to the improvement of a channel over the inner shoals from 1826 to 1837, and of the supplemental survey so far as completed, which report, with its appendices and maps, will be found on pp. 1359–1376 of the Annual Report of the Chief of Engineers for 1893.

May 20, 1893, upon the recommendation of the Division Engineer, the Chief of Engineers directed that the additional observations "still needed in order that full information be had as to the direction and velocities of currents in and near the channels * * * be undertaken as soon as possible, and that when their results are known further detailed report on the whole subject be made by the local engineer."

The additional observations were made from July 23 to October 28, 1893, and April 9 to 19, 1894; and May 14, 1894, the additional report required was submitted, which, with its appendices and accompanying charts, is subjoined.

May 18, 1894, the Chief of Engineers approved the modified project therein recommended, namely, to obtain a channel 9 feet deep and 300 feet wide through the Teachs Hole-Swash Channel by dredging a cut of that width 9 feet deep through Cockle Shoal and, to allow for shoaling, 10 feet deep through the "Swash," and that should the shoaling at the "Swash" not prove as serious as anticipated, to widen the cut there to 400 feet, to enable vessels more readily to pass through it in view of the cross currents, at an estimated cost of $29,339.38. If the above artificial channel shoal so rapidly as to make its abandonment advisable, to dredge a channel 300 feet wide and 9 feet deep through the shoal at the head of Blairs Channel, or at the head of its eastern branch, as may be advisable after further detailed examination, at an estimated further cost of $28,000.

Specifications for a contract to be entered into for the execution of the project as thus modified were transmitted to the Chief of Engineers May 21, 1894, with applications for the necessary authority to print them and advertise for proposals, which authority had not been received at the close of the fiscal year.

Pursuant to instructions of June 14, 1893, from the Chief of Engineers, the contract which had been entered into November 28, 1891, with the Alabama Dredging and Jetty Company, for $75,000 worth of dredging at 17 cents per cubic yard, to the depth of 12 feet through the inner shoals at the head of Wallace Channel, under the project of 1889, and which had been three times extended, was terminated by mutual consent by agreement supplemental thereto, entered into with that company July 5, and approved by the Chief of Engineers July 17, and by the acting Secretary of War July 20, 1893.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., May 14, 1894.

GENERAL: In my report upon the improvement of Ocracoke Inlet, North Carolina, submitted to you May 15, 1893, it was stated that information regarding the currents at the locality of the improvement was desirable, and should be obtained in the season of 1893. The Division Engineer in his indorsement of May 18 recommended, and by letter of May 20, 1893, from your office (2651), it was directed that the additional observations necessary to obtain this information be undertaken, and that when their results are known further detailed report be made on the whole subject, which report I now have the honor to submit.

The duty of making the observations I intrusted to my assistant, First Lieut. E.

W. Van C. Lucas, Corps of Engineers, who had made the supplemental survey at the inlet upon which my report of 1893 was in part based.

As soon as his other duties in the district would permit, Lieut. Lucas formed a party with which he arrived at the inlet July 23, 1893.

The work embraced current and tidal observations each at twenty-two stations in thirty-seven localities, widely separated by large areas of water so shoal as to be impassable in boats adapted to the requirements of the observations.

The field of the work was in the open sound extending 20 to 30 miles on the one hand, and exposed through the wide inlet to the open ocean on the other, with little protection against the wind from any direction by the narrow strip of land that separates ocean and sound.

After a laborious season, during which, as the period of slack water is barely of more than appreciable length in the vicinity of the inlet, the tidal stations were connected by a line of levels about 65 miles long, Lieut. Lucas, by my direction, concluded his observations October 28, 1893, after much interruption by bad weather during the greater part of that month.

April 9 to 19, 1894, he again repaired with a small party to the inlet and made a few more current observations in the Teachs Hole-Swash Channel, of which a study by me of his observations of last summer and fall revealed the necessity.

His reports, transmitted herewith, of March 21 and April 25, 1894, accompanied by one blue print chart showing the location of his stations, and by 8 sheets on which the result of his observations are plotted, contain much information upon the action of the tide and currents, of utility in forming an opinion as to the permanence of the improvement and as to the channel best adapted to it.

I will now venture to offer the conclusions and the reasons for the conclusions which, from the study of the foregoing data and of that submitted with my report of May 15, 1893, I have formed regarding the improvement and maintenance of a channel through those broad shoals of sand in so exposed a location on one of the most stormy parts of the seacoast of the United States.

Ocracoke Inlet is a waterway almost a mile and three-quarters in width, connecting Pamlico Sound with the Atlantic Ocean through the low narrow strip of beach by which the sound and ocean are separated, except at three other less practicable inlets at intervals of 14, 37½, and 7 miles.

At the mouth of the inlet in the ocean there is a bar upon which the least channel depth at mean low water is now 12 feet, although at the date of my report of May 15, 1893, it was 14 feet.

At the mouth of the inlet in the sound there is a very shoal sector-shaped area of about 32 square miles, extending radially from the throat of the inlet about 5½ to 6½ miles to the 10-foot contour in the sound, which approximately follows an arc 10 miles long from the shoal verge of the barrier beach on one side to that on the other.

While the inlet is very shoal for the greater part of its width it has a bold channel about 1,600 feet wide, 35 to 45 feet in depth at the throat, retaining thence a depth of not less than 20 feet for 5,000 feet outward toward the ocean bar, and 6,600 feet inward toward the shoals in the sound.

From this bold channel three principal channels diverge into the latter shoals:

First. Teachs Hole-Swash Channel, which immediately within the inlet curves abruptly around the point of the beach, and with a divergence of about 69° from the inlet channel follows a NNE. course close along the shore for about 2¼ miles, then deflecting from the beach, in three more courses, NNW., WNW., and NW. it reaches 9 feet of water in the sound at a channel distance of 6 miles from the inlet. This is the channel now navigated; through it 7½ feet can be carried at high, and 7.2 feet at low water from the inlet to the sound, and it is the only channel through which there can be carried more than 4½ feet.

Second. Wallace Channel, which a little within the inlet deflecting 28° southerly from the inlet channel, follows a course W. by N. ¼ N. and then NW. by W. and heads in 4½ feet of water on the shoal at 6 miles channel length from the inlet. It is the channel for the improvement of which $133,732.40 was, without success, expended between 1826 and 1837, and which has been adopted for improvement by the present project.

Third. Blairs Channel, which 1.6 miles within the inlet abruptly deflects about 78° northerly from Wallace Channel and thence for 3¼ miles lies almost due north, heading in about 3 feet of water on the shoal. This channel lies between the two others. For about 2 miles from Wallace Channel it is parallel with Teachs Hole Channel, and about 2 miles west from it. The two channels then approach each other, a branch of Blairs Channel heading within 1,500 feet of the Swash Channel, which is the continuation of Teachs Hole Channel toward the sound.

The current runs from the ocean through the inlet into the sound from that stage of flood tide when the ocean has risen to the level of the sound to that stage of ebb tide when it has ebbed to that level again, and from the sound into the ocean while the latter is ebbing from the sound level to low water and rising to the sound level again; as the ocean surface passes that of the sound when rising and falling with full rapidity at about mid-tide, the reversal of the current through the inlet is sudden at both ebb and flood, and slack water on the shoals within the inlet is of very brief duration.

The purpose of the further observations was to obtain information, as full as obtainable in one season, of the action upon the shoals and the three channels of the tidal flow diffused from the inlet over them and converging to it from them at every oscillation of the ocean level above and below that of the sound.

The observations were not confined to the channel adopted for improvement, but embraced also the two others for the advantage of comparing the condition of the channels and the action of the currents in them in elucidating the agencies to be contended against in maintaining the proposed improvement, and the best means to that end, and they have all been useful for that purpose.

The channels and the stations where tides and currents were observed are shown on the blue print (map 1) with Lieut. Lucas's report.

TIDAL OSCILLATION.

As appears from Lieut. Lucas's report the mean and extreme range of the tide in the ocean near the inlet are 3.45 feet and 4.9 feet.

The mean surface of the sound is about one-tenth of a foot (0.125′) above the mean ocean level.

In the ocean the mean and extreme tides rose 1.6 feet and 2.35 feet above, and fell 1.85 feet and 2.55 feet below the mean level of the sound.

At the throat of the inlet mean high water is six-tenths of a foot lower, and mean low water five-tenths of a foot higher than in the ocean, and the mean oscillation is 2.35 feet from 1.35 feet below to 1 foot above the mean level of the sound.

Following Wallace Channel into the sound 7,700 from the inlet (gauge 2) the mean oscillation is 3 inches less than at the throat or 2.1 feet from 1.2 feet below to 0.9 of a foot above the sound. In the next 8,000 feet, to Ayers Rock (gauge 3), 2.9 miles from the inlet, the mean oscillation decreases about 6 inches, and is 0.9 of a foot less than at the inlet, being 1.45 feet, from 0.65 of a foot below to 0.8 of a foot above the sound.

In the next 9,500 feet to Flounder Slough Rock (gauge 4) 4.7 miles from the inlet, the mean oscillation decreases 1 foot, and is only 0.45 of a foot, from 3 inches below to 0.2 of a foot above the sound. In the next 4,500 feet (to gauge 5) in 4 feet of water, 5.8 miles from the inlet, the oscillation decreases 3 inches and is only 0.2 of a foot, one-tenth of a foot below, and one-tenth of a foot above the sound. This gauge (5) was near the head of Wallace Channel, 5¾ miles, channel length, from the inlet, and near the easterly end of the cut, about 1 mile in length, which, in accordance with the project, is to be dredged to extend that channel to a navigable depth in the sound. The oscillation there at the head of that channel, 0.2 of a foot, is the same as that found at the heads of 7 other main and minor channels, or tidal guts (gauges 17, 18, 19, 20, 11, 15, and 22, map 1), respectively, 4.92, 6.43, 6.15, 5.3, 5.39, 5.5, and 5.19 miles, channel distance, from the inlet.

From observations taken through the courtesy of the light-house Board by the keeper of the Southwest Straddle light-house in the sound 10 miles northwesterly from the inlet, during the continuance of Lieut. Lucas's observations, it appears that the mean oscillation of the surface of the sound is one-tenth of a foot.

CURRENT VELOCITIES.

Wallace Channel.—The maximum observed current velocities in feet per second were as follows:

At the throat of the inlet in about 45 feet of water (Station A, map 1):

	Feet.
Flood at surface	4
Ebb at surface	4.4
Flood near bottom	3.4
Ebb near bottom	3.7

At Station B, 5,000 feet from the inlet, where the depth is 20 feet:

Flood at surface	2.6 feet, or 65 per cent of that at inlet.
Ebb at surface	3.8 feet, or 86 per cent of that at inlet.
Flood near bottom	2.3 feet, or 67¾ per cent of that at inlet.
Ebb near bottom	2.8 feet, or 76 per cent of that at inlet.

At Ayers Rock (Station C), 2 miles farther, where the depth is 22 feet, and 2.9 miles from the inlet:

Flood at surface............................3.75 feet, or 93¾ per cent of that at inlet.
Ebb at surface..............................3.3 feet, or 75 per cent of that at inlet.
Flood near bottom...........................3 feet, or 88 per cent of that at inlet.
Ebb near bottom.............................2.5 feet, or 67 per cent of that at inlet.

This very material increase of the flood velocity at Ayers Rock is ascribed to the very large increase in the volume of water that a little to the east of the rock enters the channel from the blind channel leading from Portsmouth Point.

Off Flounder Slough Rock (Station D), 1.8 miles farther, where the depth is about 19 feet, and 4.7 miles from the inlet:

Flood at surface............................3.45 feet, or 86¼ per cent of that at inlet.
Ebb at surface..............................3 feet, or 68 per cent of that at inlet.
Flood near bottom...........................2.5 feet, or 73 per cent of that at inlet.
Ebb near bottom.............................1.8 feet, or 49 per cent of that at inlet.

At Station E, a mile farther, in 12 feet of water, approaching the head of Wallace Channel, and about 5.7 miles from the inlet:

Flood at surface............................2 feet, or 50 per cent of that at inlet.
Ebb at surface..............................1.9 feet, or 43 per cent of that at inlet.
Flood near bottom...........................1.7 feet, or 50 per cent of that at inlet.
Ebb near bottom.............................1.6 feet, or 43 per cent of that at inlet.

At Station G, a half mile farther, in about 3 feet of water, at the extreme head of Wallace Channel, and 6.2 miles from the inlet:

Flood at surface............................2.2 feet, or 55 per cent of that at inlet.
Ebb at surface..............................1.7 feet, or 39 per cent of that at inlet.
Flood near bottom...........................2 feet, or 59 per cent of that at inlet.
Ebb near bottom.............................1.45 feet, or 39 per cent of that at inlet.

On the prolongation of the direction of Wallace Channel, where the channel it is proposed to dredge through the shoal would emerge in 10 feet of water in the sound, 6¾ miles from the inlet, the maximum flood and ebb velocities are equal, being 0.7 of a foot near the bottom and 0.9 of a foot near the surface.

Blairs Channel.—At Station F. in 19 feet of water, 3,800 feet from its confluence with Wallace Channel, and 2.3 miles, channel distance, from the inlet:

Flood near surface..........................2.4 feet, or 60 per cent of that at inlet.
Ebb near surface............................3 feet, or 68 per cent of that at inlet.
Flood near bottom...........................2 feet, or 59 per cent of that at inlet.
Ebb near bottom.............................2.4 feet, or 65 per cent of that at inlet.

At Station J, in 22 feet of water, 4 miles, channel distance, from the inlet:

Flood near surface..........................2.8 feet, or 70 per cent of that at inlet.
Ebb near surface............................2.9 feet, or 66 per cent of that at inlet.
Flood near bottom...........................2.4 feet, or 70 per cent of that at inlet.
Ebb near bottom.............................2.5 feet, or 67 per cent of that at inlet.

At Station K, in about 2½ feet of water, 5.4 miles, channel distance, from the inlet:

Flood near surface..........................2.3 feet, or 57½ per cent of that at inlet.
Ebb near surface............................1.9 feet, or 43 per cent of that at inlet.
Flood near bottom...........................2 feet, or 59 per cent of that at inlet.
Ebb near bottom.............................1.6 feet, or 43 per cent of that at inlet.

Teachs Hole-Swash Channel.—At Station L, in about 19 feet of water, 3,600 feet from the confluence with Wallace Channel and from the inlet:

Flood near surface..........................3.8 feet, or 95 per cent of that at inlet.
Ebb near surface............................3.8 feet, or 86 per cent of that at inlet.
Flood near bottom...........................3 feet, or 88 per cent of that at inlet.
Ebb near bottom.............................3 feet, or 81 per cent of that at inlet.

At Station M, in about 15 feet of water, 3½ miles from the inlet:

Flood near surface..........................2.1 feet, or 52½ per cent of that at inlet.
Ebb near surface............................1.9 feet, or 43 per cent of that at inlet.
Flood near bottom...........................1.6 feet, or 47 per cent of that at inlet.
Ebb near bottom.............................1.4 feet, or 38 per cent of that at inlet.

At Station N, in about 7 feet of water, 4.4 miles from the inlet:

Flood near surface..........................1.4 feet, or 35 per cent of that at inlet.
Ebb near surface............................1.3 feet, or 30 per cent of that at inlet.
Flood near bottom...........................1.15 feet, or 34 per cent of that at inlet.
Ebb near bottom.............................1.1 feet, or 30 per cent of that at inlet.

At Station Q, in 9 feet of water in the sound, nearly 5¾ miles from the inlet:

Flood near surface	1.4 feet, or 35 per cent of that at inlet.
Ebb near surface	1.3 feet, or 30 per cent of that at inlet.
Flood near bottom	1.2 feet, or 35 per cent of that at inlet.
Ebb near bottom	1.1 feet, or 30 per cent of that at inlet.

At all the five stations in Wallace Channel, 0.6 to 6.2 miles, and averaging 4 miles from the inlet, the mean flood velocity near the bottom is 67½ per cent of that at the inlet.

At the three stations in Blairs Channel and the one (B) in Wallace Channel, between Blairs Channel and the inlet, 0.6 to 5.4 miles, and averaging 3 miles from the inlet, it is 64 per cent of that at the inlet.

At the four stations in Teachs Hole-Swash Channel, 0.7 to 5¾ and averaging 3.6 miles from the inlet, it is 51 per cent of that at the inlet.

At the three uppermost stations in Wallace Channel, 4.7 to 6.2 and averaging 5¼ miles from the inlet, it is 60⅜ per cent of that at the inlet.

At the two uppermost stations in Blairs Channel, 4 to 5.4 and averaging 4.7 miles from the inlet, it is 64½ per cent. of that at the inlet.

At the three uppermost stations in Teachs Hole-Swash Channel, 3½ to 5¾ and averaging 4½ miles from the inlet, it is 38⅜ per cent. of that at the inlet.

Of these three channels, in the two, Wallace and Blairs, heading high on the shoals in 3 to 4½ feet of water, the velocity of the flood current is well sustained, with very considerable transporting power for sand, while in Teachs Hole-Swash Channel, in which is naturally maintained a minimum depth of 7½ feet (only 18 inches less than the greatest draft that can be carried to any port or shipping point accessible from Pamlico Sound), the flood current is comparatively feeble.

At the head of the two former channels on the shoals the flood exceed the ebb velocities; but in other parts of those two channels the relative velocities during flood and ebb vary materially, the ebb being the greater throughout Blairs Channel until near its head, while in Wallace Channel the flood velocity is the greater above Ayers Rock, 2.9 miles from the inlet, and the ebb the greater below it. In Teachs Hole-Swash Channel the flood and ebb velocities are equal 3,600 feet from the inlet, while at the three stations farther toward the sound the ebb is always the less, and 87½ to 96 per cent of the flood velocity.

Lieut. Lucas reports that all the observed flood and ebb velocities at all the stations in the three channels at all times, except about one-half hour before and one-half hour after slack water (which is of barely more than appreciable duration), exceed one-half foot per second or 30 feet per minute, the velocity which it is said by the authorities will just move fine sand.

Lieut. Lucas found that the following percentages of sand taken by him from the following localities in the channel pass through a sieve the clear dimensions of whose meshes was one-sixtieth of an inch:

Location.	Distance from inlet.	Through one-sixtieth sieve.
	Miles.	*Per cent.*
On outer bar	1½	64
Throat of inlet	0	9
Middle Ground Buoy	0.6	52
Beacon Island Slough	2½	56
Ayers Rock	3	67
East end of cut	6	69
Crest of shoal	6¼	80
West end of shoal	7	81

The weight of the sand found on the crest of the shoal at the head of Wallace Channel is 94 pounds per bushel, dry.

At Station U, in 3 feet of water, on the shoal at the head of Wallace Channel, 6.2 miles from the inlet, near the bottom, the flood velocity, 2 feet per second, is 59 per cent of that at the inlet, while the ebb velocity, 1.45 feet per second, is only 39 per cent of that at the inlet. The ebb velocity, 1.45 feet per second at this station, is 72½ per cent of the flood velocity, 2 feet.

At Station K, in 2½ feet of water, on the shoal at the head of Blairs Channel, 5.4 miles from the inlet, near the bottom, the flood velocity is likewise 2 feet per second, 59 per cent of that at the inlet, while the ebb velocity, 1.6 feet per second, is 43 per cent of that at the inlet. The ebb velocity, 1.6 feet per second at this station, is 80 per cent of 2 feet, the flood velocity.

The flood current, apparently retaining its velocity at those distances from the inlet to a greater degree than the ebb velocity can be acquired there, propels from the ocean bar and neighboring shoals a greater volume of sand into the slack water of the sound than the ebb current is able to return, and this effect is augmented by the heavier seas that can be driven by easterly and southeasterly winds and gales from the ocean through the inlet into the sound than can be driven from the more shallow water of the latter by the less violent westerly winds in the reverse direction. There is thus an intermittent discharge, but with ever-frequent recurrence, of a sand-burdened stream into a tideless sea.

Thus while the bold channel through the inlet is terminated seaward by a bar of the usual type often found in the ocean at the outlets of tidal estuaries, resulting from the action of the flood, ebb, and littoral currents upon the sand thrown up by the waves from the bordering shallows of the sea soundward, it is terminated by a bar of a distinctly different character, or of the delta type.

As the gradually increasing volume and height of the deposit formed on the prolongation of the axis of a stream that bears material into slack water obstructs its direct flow and deflects it laterally where the deposit is less in volume and in height, thus forming branch channels and deltas, so, near the heads of Wallace and Blairs channels, branch channels (*a*, *b*, *c*, *d*, *e*, and *f*, map 1) are noticeable that seem to have been formed in like manner. Through these branch channels the material brought up through the trunk (or principal) channel seems to be distributed, raising the crest of the shoal to its grade at the head of the main channel.

Lieut. Lucas reports these branch channels to be bordered by banks or shoals of considerable width, which are materially higher than the broad shoal areas which they bound and which lie between the heads of the several channels and their branches, from which areas these bordering shoals may retard the ebb flow and also the ebb current in the upper parts of the channels.

From current observations taken at the heads of several of these branch channels it was found that the flood exceed the ebb velocities.

As the flood current propels to the upper parts of these channels and shoals a larger volume of sand than the weaker ebb current there can return, the shoals rise by successive increments at each reversal of the tide. The flood current is able to propel less and less sand up, and the weaker ebb current more and more sand down the gradually increasing slope until the gradient is reached which equalizes these two volumes.

The height reached by the shoals at the head of the channels and their branches is 2 to 4 feet below the surface of the water in the sound.

It is apprehended that by such process, unless it be kept open by dredging, any cut will be ultimately filled that may be artificially made through the crest of these shoals from the head of any of these channels to the sound, and that the filling will be augmented by easterly and southeasterly gales, depending in degree upon the exposure of the artificial channel to them.

Whether or not the foregoing be a correct conception of the process by which the shoals have been formed, the law governing the forces which have formed them, the law of their being, will not except from its operation any part of the shoals which may be selected for deepening and appropriating to navigation.

It is not apparent that training walls would be efficacious in maintaining the artificial depth. If built of wood the teredo would speedily destroy them, and if built of riprap stone they would be a costly and unpromising experiment.

With the variable strength of the flood current in neap and spring tides and easterly and southeasterly gales varies also the volume of sand borne up the channels from the inlet, and the distance into the slack water of the sound to which it is borne, from the inferior limit of neap tides to the much greater one in violent southeasterly gales. Thus, while the 10-foot contour on the soundward slope of the shoals is 5.6 miles from the inlet in a direction N. by W. from the latter, where the Teachs Hole Swash Channel enters the sound, in the more exposed general direction of Wallace Channel, northwest by W. ½ W., that contour is a mile farther, or 6.6 miles from the inlet.

The most violent gales on that part of the coast are from the southeast, but they are the most brief in duration. A line drawn SE. and NW. through the inlet and prolonged into the sound is exactly coincident in direction with the bold channel 2 miles long, 20 to 45 feet deep, and 1,000 feet wide in the inlet, and passes longitudinally through the shank of the hook-shaped Royal Shoal, where the 10-foot contour is pushed more than 2½ miles farther into the sound, or 9¼ miles from the inlet.

The coincidence in direction of the inlet channel and of the narrow shoal that juts over 2½ miles into the sound beyond the otherwise quite regular outline of the shoals (see Coast Survey Chart No. 143), indicate the dominating effect of the most violent gales, although the most brief in duration, upon these broad shoals of shifting sand.

In Wallace Channel, which has been adopted for improvement, the flood current, as shown by the observations, has greater energy than in the other channels. The energy which maintains in that direction a bold channel to a distance from the inlet a mile greater than the same depth, 12 feet, is maintained in Blairs Channel, also bears through that channel a larger volume of sand, forming and interposing a greater barrier between its head and navigable depths in the sound; thus the distances from 9 feet of water in Blairs Channel and in one of its branches of navigable dimensions, to 9 feet of water in the sound, are respectively 1,900 and 2,100 feet, while the distance between the same depths in Wallace Channel and the sound is 4,100 feet, and the respective volumes to be removed to obtain a channel 300 feet wide and 9 feet deep are about 97,000 and 173,000 cubic yards. This difference would seem to be out of proportion to the relative capacities and current velocities of the two channels, and may be ascribed to the much greater exposure of Wallace Channel to southeasterly gales, as its general trend, NW. by W. ⅜ W., and SE. by E. ⅜ E., differs but 15½° (easterly) from the severest exposure, about due SE., while the trend of Blairs Channel is almost due north and south toward the point of Portsmouth Island.

While in easterly and southeasterly gales heavy seas from the ocean can surge almost directly into Wallace Channel, inducing currents bearing large masses of sand to its head, Blairs and Teachs Hole channels are protected from all seas by their direction and by Shark Shoal projecting far seaward from Portsmouth Point.

Thus, while the variation in the force and action of the currents in Blairs and Teachs Hole channels is restricted to the comparatively moderate limits due to neap and spring tides, to the effect of the wind within the limits of the channels themselves or on the shallow water over Shark Shoal, and to the escape laterally into them of water forced by violent gales into the main inlet channel and into Wallace Channel, the force and effect of the currents in Wallace Channel, on the other hand, are liable to much greater variations due to its comparatively great exposure to southeasterly gales.

In proof of the variable effect caused by gales in Wallace Channel may be cited the statement, on p. 1362 of the Annual Report of the Chief of Engineers for 1893, that the 10-foot contour at the head of that channel receded toward the inlet one-half mile in the twenty-seven years from 1830 to 1857, advanced into the shoals five-eighths of a mile in the twenty years from 1857 to 1877, and five-eighths of a mile in the fifteen years from 1877 to 1892. It is also shown, on the page above cited, from surveys and estimates made in 1827 and 1891, that to obtain a channel 300 feet wide and 9 feet deep from Wallace Channel to the sound required the excavation of 150,000 cubic yards in 1827, and of 155,351 cubic yards in 1891.

The net advance, three-fourths of a mile, of the channel in fifty-four years was of no benefit to navigation, as the bar at its head advanced with it and continued undiminished in magnitude.

As compared with the other two channels, the currents in Wallace Channel, augmented by gales, can maintain it to a greater distance from the inlet, can form and maintain a larger bar at its head, and, it is apprehended, can, in violent southeasterly gales, hurl into an artificial channel cut through that bar a mass of sand that would cause sudden and great deterioration, possibly filling a portion of it, or sweeping sand through it, and blocking its entrance to the sound, whose slack water must arrest the moving sand either in the dredged cut or in the sound in advance of it.

While, if funds be kept available, the means of dredging may be proportioned to the amount of shoaling of any channel caused by the usual and regular action of the tides and winds, and the channel thus be kept open for navigation, the sudden deterioration liable to be caused by violent gales can not, as regards either the time of its occurrence or its magnitude, be foreseen and provided for, and in an exposed location in such an expanse of sandy shoal sudden deterioration may be so extensive as to entail almost the entire reconstruction or abandonment of the artificial channel, to the entire interruption of navigation. It is, therefore, of very great importance that the location selected for the dredged channel be a sheltered one. The most sheltered of the three channels and of the localities of the dredging which their adoption would entail are:

First. Teachs Hole-Swash Channel, which for 2¼ miles lies close under the lee of Ocracoke Island, the dredging in which would vary from 1,200 feet to 1½ miles therefrom.

Second. Blairs Channel, about 2 miles farther west. A channel (2,100 feet long) dredged at the head of its eastern branch (*f*, map 1) would be 1¼ miles, and at the head of the main channel (Station K, map 1) about 2¼ miles from the island.

Both these channels are, as before stated, well sheltered from the ocean by their direction and by Shark Shoal.

An objection which, in former reports on this improvement, has had much weight in causing the rejection of Teachs Hole Channel, is the fact that it has several times become shoal at its confluence with Wallace Channel, which, like Blairs Channel, it meets at almost right angles. On p. 1362 of the Annual Report of the Chief of Engineers for 1893, it is stated:

"At the entrance to Teachs Hole Channel from the bar or inlet channel, where there is now a depth of 9.3 feet at low water, the surveys show a depth of 7 feet in 1830, and 5½ feet in 1852, and it is reported by mariners that since the latter date the entrance has become two or three times shoaled to 6 feet or less."

This shoaling has, it is said, except in 1852, been restricted to a "bulkhead" extending but a short distance up the channel from its mouth, which has been removed by the current. It is believed that this shoaling was caused by the lateral escape from Wallace Channel into the mouth of Teachs Hole Channel of sand borne up Wallace Channel in southeast gales, and that it would have caused as serious deterioration by lodging in a cut at the head of Wallace Channel, where, it is believed, it would have remained until dredged out, while the currents removed the deposit from Teachs Hole Channel.

The greatest depth of water that can be relied upon in the channel leading from Pamlico Sound up the Neuse River to Newbern, up the Pamlico River to Washington, and through Croatan Sound to Albemarle Sound, is 8 feet, and to any shipping points on Pamlico Sound 8½ feet, while the greatest depth in any authorized project for the improvement of those channels is 9 feet up the Pamlico River to Washington.

The estimated cost of dredging to obtain a channel of a minimum width of 300 feet and minimum depth of 9 feet from the inlet to the sound at 25 cents per cubic yard, adding 15 per cent for contingencies, is:

By Wallace Channel, for the removal of 173,123 cubic yards, $51,462.50.

By Blairs Channel (eastern branch), for the removal of 97,545 cubic yards, $28,044.19.

By Teachs Hole-Swash Channel, for the removal of 50,110 cubic yards, $14,406.63.

The foregoing estimate for Wallace Channel embraces 5,900 cubic yards for dredging at Beacon Island Slough, in that channel, where the depth is now only 7½ feet, owing to the abstraction of the flood flow by Blairs Channel and of the ebb flow by the channel heading at Portsmouth Point.

The estimate for Teachs Hole-Swash Channel embraces dredging at two localities, Cockle Shoal and the Swash. At the latter locality, where the present depth is 7.2 feet, the amount to be removed is 38,000 cubic yards, about four-fifths of the whole quantity, both the ebb and flood currents set at an angle of 60° to 90° across the best direction that can be selected for the artificial channel. This direction of the currents must be expected to produce shoaling; nevertheless, to discard without a trial the natural channel maintained to the depth of 7.2 feet by the approximately equal ebb and flood currents in favor of a line where the water is but 3 feet deep, and dredging must be to the depth of 6 feet in sand, does not seem to be wise, especially in view of the cost of giving the natural channel a trial and of the difficulties that beset all other lines.

Dredging at the head of Wallace Channel must, in my opinion, be regarded merely as an experiment to ascertain at a cost of about $51, 000 the rate of subsequent shoaling and the cost of maintenance, while for $28,000 the same experiment can be tried at the head of Blairs Channel under entirely similar conditions, excepting the great exposure of the cut at Wallace Channel, the full effects of which might not be realized for several years.

I therefore recommend that to obtain a channel 9 feet deep and 300 feet wide through the Teachs Hole-Swash Channel a cut of that depth and width be dredged in that channel at Cockle Shoal, and that to allow for shoaling a cut 300 feet wide and 10 feet deep be dredged through the shoal at the Swash, and that should the shoaling not prove as serious at this latter locality as anticipated that the cut then be widened there to 400 feet, to enable vessels more readily to pass through it, in view of the cross currents, at an estimated total cost of $29,339.38.

If the artificial channel in Teachs Hole-Swash Channel shoal so rapidly as to make its abandonment advisable, I recommend that a channel 300 feet wide and 9 feet deep be dredged through the shoal either at the head of Blairs Channel or at the head of its eastern branch, at an estimated cost of $28,000.

Further observation of the currents and other conditions should be made before deciding whether to adopt the branch or main Blairs Channel.

The trial of both the Teachs Hole-Swash and Blairs channels can be made for about the cost of the one trial at Wallace Channel. If the depth of 9 feet be maintained through either of them, it will give all needed present relief to navigation; it will show what development of commerce through the inlet will be caused by removing the obstruction from the channel over the shoals, and it will throw light on the question of the necessity, advisability, method, and cost of obtaining and maintaining a greater depth, and upon the best locality at which to make the effort (depths of 10, 13, and 15 feet having been mentioned in the original project of 1889).

I have nothing to add to what was said in my report of May 15, 1893, as to the commercial aspects of the project and of the advantages and disadvantages to navigation of the route through the inlet, except that Lieut. Lucas found during his observations at Ocracoke from July 23 to October 28, 1893, that after passing from Pamlico Sound over the shoals and reaching the inlet, vessels bound north were detained an average length of time of one week for favorable winds to enable them to sail from the inlet around Cape Hatteras, and, as stated in my report of a year ago, nearly all vessels sailing from the inlet are bound north.

Very respectfully, your obedient servant,

W. S. STANTON,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

Money statement.

July 1, 1893, balance unexpended	$99,876.85
June 30, 1894, amount expended during fiscal year	4,864.58
July 1, 1894, balance unexpended	95,012.27
July 1, 1894, outstanding liabilities	32.68
July 1, 1894, balance available	94,979.59

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., March 21, 1894.

SIR: I have the honor to submit the following report of the work done by a party under my charge, at Ocracoke Inlet, North Carolina, between July 23 and October 28, 1893, in accordance with instructions contained in your letter to me of July 19, 1893.

The party and plant were assembled at the engineer depot at Washington, N. C., and on July 22 I arrived at Ocracoke with an advance party of three men, and immediately began the preliminary work of locating and placing tide gauges. The remainder of the party, with instruments and outfit, arrived July 26, and by August 1 the preliminary work was sufficiently advanced to enable us to commence regular observations, but a necessary part of the meter outfit was not received until August 4, and current observations were consequently delayed until August 7.

The party was divided into three groups, all working under my immediate supervision and direction, for leveling, gauge reading, and observing current velocities.

The leveling party, consisting of four men, with Surveyor S. F. Burbank as instrument man in charge, placed the tide gauges at the designated locations and connected them by lines of levels to the benchmark at Ocracoke light-house. Mr. Burbank's work involved his being constantly in the water, and was particularly difficult and disagreeable, and he is entitled to great credit for the thoroughness and care with which he performed his part.

From three to five gauge readers took simultaneous observations at various points during each working day.

Current meters were operated by parties of three or four men for each meter. Beginning the work on August 7 with one meter, I received two more in August and worked regularly with two after August 31. About the time the third meter was ready for use the first one had to be sent to Boston for repairs and it was not returned in time to be of any further service. Mr. J. S. Codman, of Boston, Mass., joined the party August 29, and was assigned to duty as chief current observer, in which capacity he did most efficient work and was of great assistance to me.

The weather during August and September was favorable for good work, about two in every three days being excellent for our purposes. During October the weather was, on the contrary, so unfavorable as to afford us only about one good day in every three, and the good days were so scattered as to seriously interfere with the continuity of observations; consequently the plan of operations had to be continually changed and work was done under a great variety of conditions. All of the work done in October could have been better done in one week of good weather, and at about one-fourth of the expense. Had it been possible for me to have worked with the three meters from August 1, I could have accomplished the same amount of work as was actually done by the middle of September, and the results so obtained would have been better than those actually obtained because of the much better weather conditions existing up to that date.

During the progress of the work an anemometer and wind gauge of the standard U. S. Weather Bureau pattern was set up and used, and with this instrument a continuous record of wind velocities and directions, from August 19 to October 26, was obtained.

During the same period barometer readings were taken and recorded every two hours from 7 o'clock a. m. until 9 o'clock p. m., inclusive.

Field work was stopped October 27. The party left Ocracoke October 28, arrived at the depot at Washington, N. C., October 29, and was there disbanded. All boats and heavy material were left at the depot to be overhauled and put in order, and all instruments were forwarded to the Wilmington office.

The cost of the season's work was as follows:

Labor	$2,201.52
Subsistence, at 34½ cents per man per day	442.15
Rent (quarters and wharf privileges)	46.60
Telegrams	8.69
Towing	158.10
Miscellaneous supplies (coal for steamer, naphtha for launch, lumber, oil, etc.)	312.10
Transportation (traveling expenses of members of party)	126.73
Express and freight charges	74.57
New plant (including anemometer and wind gauge, and other things taken up on property list and in condition for further use)	503.88
Total	3,874.34

The results of the field work and the conclusions deduced therefrom are given below, and are illustrated by the following-named maps and charts accompanying this report:

Map 1, of inner shoals at Ocracoke Inlet, showing level lines, tide gauges, current velocity stations, and places where borings were made.

Map 2, of Flounder Slough, Old Swash, and west end of Old Ship Channel.

Map 3, of inner shoals, showing graphically the variations and relative strengths of bottom flood and ebb current velocities along the three principal channels.

Chart 1, showing maximum slopes between the sound and ocean at mean high water and mean low water; also the mean sound level and the mean ocean level.

Charts 2A and 2B, showing mean velocity curves at each current station, grouped by channels, for surface currents.

Charts 3A and 3B, showing mean velocity curves at each current station, grouped by channels, for bottom currents.

Chart 4A, showing variation of maximum current velocities at surface and bottom along the four principal channels.

Chart 4B, giving a graphic analysis of chart 4A.

Chart 5, showing variation of maximum current velocities along perimeter of inner shoals, and the points where lines of maximum flow between ocean and sound cross inner shoals.

It should be borne in mind, in considering the following results, that the area covered by the observations is quite large (about 36 square miles) and that the time devoted to them was limited. The object sought was to obtain a general idea of the tidal conditions governing at Ocracoke Inlet, and this object was, I think, accomplished. It is to be expected, however, that a more detailed and longer series of observations, should any such be made in the future, would reveal numerous discrepancies, and I have endeavored in this report to give my methods and the extent of my observations at all points, in order that a fair idea may be obtained of the value of my conclusions and the weight that may justly be given them.

RESULTS.

1. CONDITION OF OUTER BAR CHANNELS.

The channels over the outer bar have changed considerably since they were sounded in 1892. In August last the northeast channel was said to have a depth of 12 feet at mean low water, a loss of 2 feet since 1892, and the southeast channel a depth of 12 feet at mean low water, a gain of 2 feet since 1892. The latter channel, being the more direct route, was being used more than the former. On March 11, 1894, I sounded the southeast channel and found a least depth of 12 feet on the crest of the bar. Capt. Bragg, the principal pilot, told me the same day that he thought the northeast channel still had a least depth of 12 feet, but I am disposed to think that it has not that much water as it has been steadily shoaling for the last two years. It was known to have only 12 feet depth in August, 1893 (since which time it has been little used), and when I examined it on the 11th instant the sea there was so much heavier than that on the southeast bar that I did not care to risk the passage through it with the steamer *Genl. Geo. Thom*, although I passed over the southeast bar in the same boat with ease and comfort.

The present southeast channel is probably three times as wide as in 1892, and at least 2 feet deeper, while the present northeast channel is hardly more than half as wide as in 1892, and has at least 2 feet less water. The southeast channel is much wider and straighter than the northeast channel and the former appears to be improving as rapidly as the latter is deteriorating. The movement of the bar shoals indicates a gradual closing up of the northeast channel, and I do not think it will be at all practicable very much longer; and as it shoals a gradual deepening of the southeast channel to 14 or 15 feet may be looked for. At present the southeast channel is the only one buoyed and is used almost exclusively.

2. TIDES AND SLOPES.

Map 1 shows the positions of the tide gauges, and Chart 1 shows the maximum slopes at mean high water and mean low water along the channels from gauge to gauge.

The velocity of propagation of the tidal wave inside of the inlet is approximately 1,600 to 2,000 feet per minute.

The principal conditions affecting the tides inside the inlet are, (*a*) height of ocean tidal wave, (*b*) amount of fresh water discharge from the sound, and (*c*) wind effects. These conditions are ever changing and give rise to an endless variety of results. Concerning these conditions it may be stated of—

(*a*) That as the changes in height of the ocean tidal wave are caused mainly by changes in the relative positions of the moon and sun, approximate allowances can be made to reduce the observed height of the wave to its mean height.

Concerning (*b*), the volume of the fresh-water discharge can only be ascertained by gauging, a difficult operation at this place, which I could not attempt last summer. But (1) Albermarle and Pamlico sounds are shallow and of large area, and the percentage of evaporation must be very large; (2) the mean sound level is but 0.125 feet (approximately) above the ocean level; and (3) the ebb current flows about 15 minutes, or 4 per cent longer than the flood current, the maximum ebb velocity is about 0.4 feet per second, or 10 per cent greater than the maximum flood velocity, and the mean channel depth is about 1.2 feet, or 8 per cent less during the ebb flow than during the flood flow; in other words, the ebb flow is greater than the flood flow by about 4 per cent in duration and about 10 per cent in velocity, and it is less than the flood flow by about 8 per cent in depth. I am therefore of the opinion that the volume of the fresh-water discharge through the inlet is small in comparison with the volume of the tidal flow.

Concerning (*c*) wind effects are greatest in the sound and least at the inlet. They are referred to at greater length in part 6 of this report.

An examination of Chart 1 shows that the channel from the outer bar through Blairs Channel to its head on the inner shoal is the least obstructed of any, the slopes being fairly regular for both high and low water. The only obstacles are, for the flood current the change in direction of nearly 90° opposite the east end of Beacon Island Slough, and for the ebb current the turn at Ocracoke Point, the blocking effect of which is increased by the cross current entering from Teachs Hole Channel.

The Teachs Hole Channel slopes indicate a rapid blocking of the channel from the inlet, quite evident upon examining Map 1, and accompanied by an equally rapid deterioration for purposes of navigation.

The Wallace Channel slopes indicate a decided obstruction for the flood current at Ayers Rock. The ebb slope is, however, quite regular.

It is worthy of note that the obstructions in Teachs Hole Channel are sand shoals that have been constantly changing, while the Wallace Channel obstructions are shell rocks that have held the channel in its present position for over sixty years, and probably much longer.

The slack-water level I found to be apparently coincident with the mean sound level and approximately the same for both high and low water slacks.

The mean ocean level is approximately 0.125 foot below the mean sound level.

The slope at the proposed location for a dredged cut at the head of Wallace Channel is about 0.025 foot per mile, and is about the same for both high and low water.

Methods.—All tide gauges were placed in position with the aid of a hand force pump, by means of which the supports were sunk 4 to 6 feet into the sandy bottom, and to the supports the ordinary staff gauges were attached. Inside the inlet the supports were of 4 by 4 inch scantling. The ocean tide gauge was a staff gauge about twice the usual thickness, attached to a standard of 3-inch wrought-iron pipe by bolts placed at 3-foot intervals; the gauge-board was faced at each bolt hole with an iron plate to prevent splitting along the line of bolt holes; each bolt, therefore, passed through the pipe standard, the gauge board, the iron plate, an iron washer, and the nut at its end to hold it in place.

The Stierle automatic tide gauge was mounted in its portable house, which was supported on four 6 by 8 inch posts, sunk with the pump about 5 feet into the sandy bottom. It was located about 6 miles from the quarters of the party, was visited about once each week and set for the next week, and during a period of over two months it made an accurate and continuous record of the water level.

A staff gauge, while not a good one for the ocean, was the only kind available for this work. As the ocean surface was never quite level, readings were taken for both crest and hollow of a wave, and, following Stevenson's rule, one-third of the wave height so obtained was added to the lower reading to obtain the mean water level at the time of reading. The gauge was placed in a low-water depth of about 4 feet, the tide range was about 3½ feet, and when the wave height exceeded 18 inches the observations were not used.

Since the completion of the above work I have obtained a copy of U. S. Coast and Geodetic Survey Bulletin No. 12 of the year 1889, which contains a description of a siphon tide guage for the open seacoast used in connection with hydrographic work at Cape Cod in 1888. The gauge so described appears to be far superior to the crude gauge I used at Ocracoke, and is probably the best arrangement yet devised for obtaining accurate water-level readings along an ocean beach.

3. LEVELS.

Lines of levels were run, as nearly as possible along the crests of the shoals, from the main bench mark at Ocracoke light-house to every tide gauge excepting that at the light-house on the southwest point of Royal Shoal, which was connected with the system by simultaneous gauge readings taken at slack water on calm days. Secondary bench marks were established at Beacon Island, Flounder Slough Rock, and at Portsmouth, near Haulover Point, all of which are described in detail below.

The object of the leveling was to obtain the relative elevations of the gauge zeros and refer them to the Ocracoke light bench mark, and from the data obtained I get the following:

	Feet.
The level at mean low water of the ocean outside of the inlet	(B. M.)—8.8
The mean height of the surface of the sound above that level	1.85
The mean rise of tide exterior to the inlet above the plane of mean low water.	3.45
The extreme rise of tide exterior to the inlet above the plane of mean low water	4.2
The fall of extreme low water exterior to the inlet below the plane of mean low water	0.7
The level at mean low water at the gorge or throat of the inlet	(B. M.)—8.3
The mean rise of the tide at the same place	2.35

References and vertical oscillations of water surface at all gauges, all references being to the bench mark at Ocracoke light:

OUTER BAR TO HEAD OF BLAIRS CHANNEL.

Gauge No.	M. L. W. reference.	M. H. W. reference.	Tide range.	Distance from inlet (soundward).
	Feet.	*Feet.*	*Feet.*	*Feet.*
16	—8.8	—5.35	3.45	*11.000
1	—8.3	—5.95	2.35	....
2	—8.15	—6.05	2.1	7,500
10	—7.45	—6.55	0.9	21.000
11	—7.05	—6.85	0.2	28.500

Seaward.

WALLACE CHANNEL.

Gauge No.	M. L. W. reference.	M. H. W. reference.	Tide range.	Distance from inlet (soundward).
6	—8.0	—6.05	1.95	6.000
3	—7.6	—6.15	1.45	15 500
4	—7.2	—6.75	0.45	25.000
5	—7.05	—6.85	0.2	30.500
23	—7.0	—6.9	0.1	44.500

OLD SHIP CHANNEL.

Gauge No.	M. L. W. reference.	M. H. W. reference.	Tide range.	Distance from inlet (soundward).
	Feet.	*Feet.*	*Feet.*	*Feet.*
8	—7.6	—6.35	1.25	16,000
9	—7.15	—6.8	0.35	27,000

TEACHS HOLE CHANNEL.

12	—7.75	—6.25	1.5	7,500
13	—7.45	—6.55	0.9	13,500
14	—7.25	—6.675	0.575	22,500
15	—7.05	—6.85	0.2	29,000

The following seven gauges along the crest of the inner shoal have the same references and the same range of tide. Their M. L. W. reference is —7.05; M. H. W. references, —6.85, and mean tide range, 0.2 feet:

Gauge No.	At head of—	Depth of water.	Distance from inlet.
		Feet.	*Feet.*
17	Little Channel	3	26,000
18	Mount Vernon Slough	4½	34,000
5	West Branch Wallace Channel	4	30,500
19	North Branch Wallace Channel	3	32,500
20	West Branch Blairs Channel	2	28,000
11	North Branch Blairs Channel	2½	28,500
15	Big Foot Slough	4	29,000

The ocean surface is above the sound surface during the flood inflow about 6 hours 5 minutes; it is below the sound surface during the ebb outflow about 6 hours 20 minutes.

The following bench marks were established:

1. At Ocracoke light-house, a cross cut in top surface of light-house doorsill, at south end of sill, about 4 inches from corner of door facing, and on line with same.

2. On Beacon Island, an iron pipe driven into the ground near the high-water line at east end of the island. Top of this pipe is 3.547 feet below the Ocracoke light bench mark.

3. On Flounder Slough Rock, an iron pipe driven into the rock at the south end of its western half. The same pipe marks the Flounder Slough triangulation station of the surveys of 1892 and 1893. The top of this pipe is 3.184 feet below the Ocracoke light bench mark.

4. At Portsmouth, near Haulover Point, a cross cut in the horizontal surface (about 2 feet from the ground) at the north end of the stone foundation of the brick chimney attached to the first house from Haulover Point, owned and (in 1893) occupied by James Mayo. This bench mark is 3.408 feet below the Ocracoke light bench mark.

Methods.—The instrument used is a precise level, belonging to this office, somewhat similar to the precise levels used on the U. S. Coast Survey work. In leveling over water, pieces of 4 by 4-inch scantling were sunk about 4 feet into the sandy bottom with a hand force pump for supporting the instrument; their upper ends were so cut as to leave a horizontal surface upon which the instrument rested, lateral motion of the instrument being prevented by nails driven into the top surface of the post against which the lower plate of the instrument was pushed. Pieces of 2 by 4-inch scantling were similarly sunk to support the level rod, and back and fore sights were made equal in length with the transit and stadia. The lines of levels followed as nearly as possible the crests of the shoals, and inclined braces were used to steady the instrument posts when the depth of water exceeded 3 feet.

The leveling party consisted of 4 men: the instrument man stood in water, with a large skiff and boatman alongside, and two men in a small rowboat carried the rod.

Sights over water were from 1,000 to 1,500 feet in length, and each line was checked one or more times. Sights on land were much shorter, but were not as accurate as those over water. A sight of 1,000 to 1,500 feet seems of excessive length, but the instrument used was a very good one, the work was done with the utmost care under none but the most favorable conditions, and the error in a line 15 miles long (starting from the Ocracoke light bench mark and returning to the same point) was less than 0.15 foot, or less than 0.01 foot per mile.

4. CURRENT VELOCITIES.

Stations were established at intervals along the four principal channel routes and at the heads of the principal branches, at which regular observations were taken for current velocities. These stations are shown on Map 1.

From the results of observations, velocity curves for the mean currents 1 foot below the surface and 2 feet above the bottom were constructed and plotted as shown on Charts 2A, 2B, 3A, and 3B. Each group of curves on these charts represents a single channel and each pair of curves in a group represents the flood and ebb velocities at a particular station in that channel, the flood velocities being plotted above the zero line and the ebb velocities below.

The maximum flood and ebb velocities at a station are considered as characteristic of that station, and Chart 4A shows the variation of those maximum velocities along the different channels and also compares the maximum flood and ebb velocities with each other. Chart 4B compares similar velocities of the different channels.

Durations of mean flood and mean ebb flows are shown in lunar time on Charts 2A, 2B, 3A, and 3B, and the average duration of the ebb flow was found to exceed that of the flood flow about 15 minutes mean solar time.

The currents of least velocity obtained are those 2 feet above bottom, and are plotted on Charts 3A and 3B. An examination of these charts will show that the velocities exceed one-half foot per second, or 30 feet per minute, at all times during either ebb or flood flow, with the exception of about one-half hour before and one-half hour after slack water. An exception to this rule must be made for Station H, in Old Ship Channel, near North Rock, where the bottom velocity rarely exceeds one-half foot per second at any time. At this station, however, the old channel has almost disappeared and the tidal flow resembles that over the surrounding shoals more than that through the other channels.

Chart 4A shows that the flood current exceeds the ebb in Wallace Channel, Teachs Hole Channel, and Old Ship Channel, while the reverse is the case in Blairs Channel. The Wallace Channel velocity diagram also indicates that at the head of this channel there is a sudden increase of flood velocity at the point where the flood current is forced over the bulkhead; and I think that further observations would show the same thing at the head of all channels so bulkheaded.

The diagrams of Chart 4B indicate that the surface flood and ebb currents and the bottom flood current are stronger in Wallace Channel than the similar currents in any of the other channels. The bottom ebb of Blairs Channel is stronger, but less regular than that in Wallace Channel.

Observations for current velocities were taken March 10, 1894, at the location of the west end of the proposed cut through Royal Shoal, with the following results:

Flood and ebb velocities are about equal, and attain a maximum at the surface (— 1½ foot) of 0.9 foot per second, and at the bottom (+ 1½ foot) of 0.7 foot per second. Compared with the velocities obtained at the head of Wallace Channel, there is a *flood* decrease from 2.3 feet surface and 2 feet bottom at the head of Wallace Channel to 0.9 foot surface and 0.7 foot bottom at the west end of the cut, and an *ebb* increase from 0.9 foot surface and 0.7 foot bottom at the west end of the cut to 1.7 feet surface and 1.45 feet bottom at the head of Wallace Channel.

I was unable to take meter observations for velocity over the shoals, as by the time the channel observations were finished the season was far advanced, and the weather conditions too bad for such work. During my frequent visits to these localities I noted the conditions as closely as possible, and can give the following very general conclusions concerning their currents:

Between Ocracoke and Portsmouth points is the extensive Shark Shoal, which, beginning in a point on the south side of Beacon Island Slough, gradually increases in width in a southeasterly direction, and, extending into the ocean, constitutes the greater part of the outer bar of Ocracoke Inlet. Over this shoal flows a great mass of water at every tide, all of the Portsmouth Point Channel water and much of that to and from the other channels taking this route. About one-fourth of the way from Portsmouth Point to Ocracoke Point some few acres of the shoal are bare at low water and over the rest of it the depth of water varies from 1 to 5 feet. I think that this bare shoal divides the ebb current from the Portsmouth Point Channel, one part flowing directly over the shoal to the ocean and the other and greater part entering the main channel near Ocracoke Point. The current velocities across it are high, and at the throat of the inlet are estimated at 3 to 4 feet per second.

Between Old Ship and Blairs channels the shoal has 2 to 3 feet depth of water and is covered with grass, which is generally found growing on a muddy bottom, and prevents any bottom movement. Along the edge of Blairs Channel the flood velocity is about 2 feet per second, but diminishes rapidly toward the west to less than ½ foot per second. The ebb current velocity is very slight over its western part and gradually increases toward the east to Blairs Channel, on the edge of which it is is about 15 per cent less than the flood current at the same place.

The shoal between Blairs and Teachs Hole channels has 1 to 3 feet depth of water, and the lower (southern) part is of bare sand, the surface of which is in constant motion during the strength of either tidal current. The upper (northern) part is to a great extent covered over with grass, which protects it from scour. The currents have in former years cut fresh channels through this shoal, and the same thing is liable to happen again in the future.

The map of the 1892 survey shows traces of a channel running approximately north and south through the center of the shoal, which was, a few years ago, sufficiently large to constitute the principal channel for vessels passing through the inlet. Over the lower part of this shoal the flood current flows in a NNW. direction toward Blairs Channel, and over the upper part in a N. to NE. direction toward the Swash. The flood velocities are estimated at 3½ feet to 2½ feet per second over the lower part, and decrease rapidly toward the north. The ebb velocities are somewhat greater than the flood, and their directions are reversed.

Methods.—(1) *Boats.*—The boats used for current observation were a 30-foot naphtha launch, the 45-foot steamer *Elsie*, and 2 file-bottom fishing boats, respectively 26 and 30 feet in length.

The advantages of these boats were as follows: The launch was roomy, carried its own motive power, and was of light draft; the steamer was roomy, afforded sufficient protection for work in the rain or at night, and carried its own motive power; the fishing skiffs were seaworthy and fast sailers, easily handled by 2 men, of light draft, and sufficiently light to be rowed when becalmed. They were remarkably steady boats and were used in stormy weather in preference to either launch or steamer. The disadvantages were: The launch afforded no protection from rain when on station, and its round bottom caused excessive rolling in the least sea, which seriously interfered with the accuracy of observations; the steamer had a similar disadvantage arising from its round bottom; the skiffs had limited room and could be used only for observation with the Price meter. They afforded the observer no protection from the rain and depended on the wind for rapid movement. After September 1, I rarely used the launch for current observations, the skiffs being better for that purpose, and the launch being particularly useful for inspections and for visiting passing vessels.

(2) *Tackle.*—On the *Elsie* a 15-foot mast was set up amidships against the deck house, a 15-foot boom attached thereto, and 3 snatch blocks used to guide the cable from the water along the boom to the mast and thence to the reel in front of the pilot house. The boom swung aft so as to deposit the meter on the after deck.

On the launch a similar mast was stepped at the forward end of the cockpit, and a similar arrangement of boom and snatch blocks guided the cable to the reel placed amidships. The boom swung the meter in back of the reel.

On the skiffs a 15-foot boom rested against a saddle at the foot of the mast, and snatch blocks at both ends of the boom guided the cable into the boat.

The reel was a necessity with the Ritchie-Haskell meter, with which a 3-conductor wire cable was used. The cable used with the Price meter was of three-quarter-inch manila rope, marked in feet and fathoms, and the working wires were lashed to the cable for the first 2 feet from the meter, from which point they were run independently to the boat.

(3) Stations were located at first by buoys and afterwards by ranges, as the strong currents caused the buoy cables to chafe and cut loose, and the buoys were generally carried to sea before they had been in place two weeks.

(4) When on stations observations were taken every half lunar hour, at surface (—1 foot), mid-depth, and bottom (+2 feet), in the order named. The velocities so obtained were plotted in the manner shown on charts 2A, 2B, 3A, and 3B, and from the partial curves so obtained were constructed the mean velocity curves of the above-mentioned charts. In determining mean velocities, allowances were made for winds and the relative positions of the moon and sun.

I obtained good velocity results with both the Price and the Ritchie-Haskell meters, but the average observer appears to have much less trouble with the former than with the latter.

When using the Price meter in salt water it was found necessary to cover with soap or some similar insulating material the exposed binding post of the wire leading to the spring contact, otherwise the salt water was a sufficiently good conductor to short circuit the working current and prevent its registering the revolutions of the wheel. I was unable to successfully use the direction part of the Ritchie-Haskell meter, and after many efforts I ceased attempting to do anything with it.

My experience in taking current observations suggests the following as conditions to be as nearly as possible fulfilled in doing similar work:

(1) As many instruments as possible should be simultaneously used.

(2) A set of observations should be continuous and include at least two complete tides.

(3) The boat should be flat bottomed, as least liable to roll in a seaway, and sufficiently large to allow the working party to live aboard and work at night whenever desirable; it should be anchored bow and stern, and the anchor cables at bow and stern should be shifted at each change of tide to stern and bow, respectively, to enable the boat always to head against the current.

(4) The meter should be swung into the water as far forward as possible and well clear of the boat in order that the velocities obtained may not be affected by the presence of the boat.

(5) Each observer should be provided with a coil of spare wire, wire pliers, wire cutters, and rubber joint insulation, and should be able to make a serviceable wire joint securely insulated.

5. DISTRIBUTION.

The mass of water forced through the inlet by the flood tide makes its way through the channels and over the shoals in various directions toward the sound. The point of shoal about 1 mile southeast of Beacon Island marks the beginning of the separation of this mass into two distinct parts, one of which flows in a northerly direction into the sound above Bluff Shoal, and the other in a westerly direction into the sound below Bluff Shoal.

The water flowing toward the upper sound is carried through Blairs and Teachs Hole Channels and over the intervening shoal, but about opposite Ocracoke light these channels begin to converge, until at Eight-Foot Shoal the water from both channels passes into the sound as one body.

The water flowing toward the lower sound follows Wallace Channel, some of it escaping through the sloughs and over the shoals toward the southwest, but the greater part flowing over the shoal at the head of Wallace Channel into Royal Shoal Harbor, whence it escapes in a southwesterly direction into the sound.

The flood currents, therefore, flow into the sound along two principal lines, over Eight-Foot Shoal and through Royal Shoal Harbor, and along these two principal lines of flow lie the main communicating passages between the inlet and the two basins of Pamlico Sound referred to in part 3, Appendix B, of my report to you on Ocracoke Inlet under date of February 18, 1893.

These two lines are also the lines of maximum flow as is shown by Chart 5. While the gauge readings indicate that the vertical oscillation of the water surface along the crest of the shoal is very small (about 0.2 foot), and practically the same at all points, the current observations show (see Chart 5) decidedly greater velocities at those points of the line where the two principal lines of flow cross the shoal than at any other points of the line; it is, therefore, a fair conclusion that the two principal lines of flow are also lines of maximum flow.

The ebb flow from sound to ocean takes the same lines, but its velocities are not so much greater at the points where they cross the shoal, the ebb flow across the shoal being more nearly even at all points of the crest and the concentration into channels taking place after the shoal is crossed.

6. WIND EFFECTS.

The general effect of northerly winds is to raise the sound level, and of southerly winds to lower it. These effects were clearly shown by the automatic gauge record particularly during the two storms of August 23 and 28. The storm of August 23 was from the NE. to NW., and raised the water level to 3.6 feet on the gauge, and that of August 28 was from SE. to SW., and lowered the water level to 0.2 foot. The mean low-water level reading on this gauge was 1.1 feet, and the mean tidal range 0.45 foot. Allowing for variation in the moon's position the vertical oscillation due to winds was about 3.5 feet.

At the light-house on Southwest Point, Royal Shoal, the vertical tidal oscillation averages about 0.1 foot, and a moderate wind of about 15 miles per hour velocity will cause at this point as great or greater oscillation. It is, therefore, apparent that any observations for sound level are of little value unless accompanied by simultaneous wind observations.

At the inlet the currents are strong, the tidal range over 2 feet, and wind effects are much less. As the inlet is approached, therefore, the necessity for wind observations grows less.

7. COMPARATIVE REACH OF TIDAL INFLUENCE.

As stated in part 5, the tidal flow at the crest of the shoal is along two principal lines, one passing over Eight-Foot Shoal in a northerly direction and the other through Royal Shoal Harbor in a southwesterly direction.

Simultaneous observations were taken along these two lines during a flood tide and the following ebb, and it was found that the flood current was perceptible from Teachs Hole Channel 1 mile and from Wallace Channel 8 miles beyond the crest of the shoal; and that the ebb current was perceptible from Teachs Hole Channel 1 mile and from Wallace Channel about 4 miles from the crest of the shoal. I was unable to verify these results by further observations, but those obtained were taken under very favorable conditions, and I think warrant the assumption that the tidal effects extend much farther from Wallace Channel than from Teachs Hole Channel.

Teachs Hole Channel is the direct line of communication between Ocracoke Inlet and the upper sound, which has equally direct communication with Hatteras Inlet, distant about 18 miles from Ocracoke Inlet. During a flood tide the currents flow from both inlets into the reservoir of the upper sound, gradually raising its surface and checking each other's flow. During an ebb tide the currents flow from this reservoir toward both inlets, each current limiting the area from which the other draws its supply. As similar tidal currents flow simultaneously to and from both inlets, it is probable that the tidal effect from either inlet can not be perceptible under ordinary circumstances at a greater distance than about 9 miles, or half the distance between the two inlets, and by my observations I found the Ocracoke currents perceptible about 1 mile beyond the crest of the shoal, or 8 miles from the inlet.

Wallace Channel is the direct line of communication between Ocracoke Inlet and the lower sound, which has a much less direct communication with Beaufort Inlet, distant from Ocracoke Inlet about 50 miles, through the narrow and shallow Core Sound. During a flood tide the currents flow from Ocracoke Inlet and Beaufort Inlet toward the reservoir of the lower sound, but the current from Ocracoke flows directly into the reservoir, while that from Beaufort must first pass through the 35 miles of obstructed channel in Core Sound. It is therefore evident that the Ocracoke current must reach the reservoir much sooner than the Beaufort current, and I think it probable that the two currents meet somewhere in Core Sound. I found the flood current from Ocracoke perceptible about 15 miles from the inlet and not far from the head of Core Sound when the flood current at the inlet had been running about three hours; and it seems to me probable that, at an earlier stage of the tide, this current may be perceived for some distance into Core Sound. During the ebb tide the current from this reservoir toward Ocracoke must begin to flow considerably sooner than that toward Beaufort, and it is not improbable that the latter part of the flood from Beaufort Inlet joins the first part of the ebb toward Ocracoke Inlet. I found an ebb current toward Ocracoke perceptible about 4 miles from the crest of the shoal, or 11 miles from the inlet, but I think that during some stages of the ebb tide the Ocracoke ebb current is perceptible fully as far from the inlet as the head of Core Sound.

It is certain that the Wallace Channel tidal currents extend much farther into the sound than those from Teachs Hole Channel, and I think it a fair conclusion that they extend as far, or farther, than Harbor Island Light, at the head of Core Sound.

8. BORINGS.

Samples of sand were obtained from various points along the bottom of Wallace Channel and across the shoal at its head, and after having been thoroughly dried were sifted through two sieves, with holes respectively one-sixtieth and one-eightieth inch in diameter, with the following results:

Location.	Distance from inlet.	Coarse.	Through one-sixtieth sieve.	Through one-eightieth sieve.
	Miles.	*Per cent.*	*Per cent.*	*Per cent.*
On outer bar	1¼	36	64	10
Throat of inlet		91	9	3
Middle Ground Buoy	0.6	48	52	10
Beacon Island Slough	2½	44	56	9
Ayers Rock	3	33	67	18
East end of cut	6	31	69	32
Crest of shoal	6¼	20	80	42
West end of cut	7	19	81	28

9. BOTTOM SAND MOVEMENT.

During two-thirds to three-fourths of each tide the bottom sand of the area east and south of the lines Portsmouth Point-Beacon Island and Beacon Island-Browns Point is in a state of constant motion. When the surface is not disturbed by wind, clouds of sand torn from the bottom of the deep channels can be seen floating to the surface during the strength of every tide.

Beyond this area the sand movement is much less, but the current observations show that in the three largest channels and on the shoals at their heads the current velocities 2 feet from the bottom exceed 1 foot per second during more than two-thirds of each tide; this velocity is sufficiently strong to move fine gravel, and it seems very probable that the bottom velocities at all parts of these channels is at least one-half foot per second, the velocity necessary to move the fine sand of which the bottom is composed. This conclusion is fully confirmed by the results of a few observations I have been able to take on perfectly calm days for velocities within less than 1 foot from the bottom; they indicated very slight differences in velocities 2 feet and 9 inches from the bottom, and tend to show that for all practical purposes the actual bottom velocity is the same as that 2 feet from the bottom.

During stormy weather the water over the shoal and far into the sound carries in suspension so much sand as to give it a clouded and grayish appearance, and it usually requires two or three days of quiet weather after a storm to enable this sand to settle again.

10. SOUNDINGS.

A survey was made in the vicinity of North Rock and Flounder Slough Rock, the plot of which is herewith submitted. (Map 2.)

This map shows the present condition of the channel dredged in 1830–'35 through Flounder Slough and the old "Swash" (see p. 1360, Rept. Chf. of Eng., 1893), and it is worthy of note that the present condition and the practicable depth along the line of this old dredging are about the same as in 1830, before any dredging was done. This map gives the data necessary for estimating the cost of a dike from North Rock to close Old Ship Channel at its western end.

Should it be found necessary to resort to diking, however, I am of the opinion that it could be done more effectively either at the old "Swash" or across Wallace Channel in prolongation to the east of the line of the proposed dredging through Royal Shoal. A dike across Old Ship Channel from North Rock would probably injuriously affect Wallace Channel, because it would force the ebb flow that now passes through the former to pass through Flounder Slough, the capacity of Flounder Slough would consequently be increased, and it would take from Wallace Channel more of the flood flow than it now does, and consequently the shoaling tendency at the head of Wallace Channel would become greater than it now is.

A dike across the old "Swash" would close both old Ship Channel and Flounder Slough, and result in forcing the ebb flow from both channels and the flood flow from Flounder Slough through Wallace Channel. The resulting increase of ebb flow would probably be about double the increase of flood flow, and the general tendency would be toward equalizing the flood and ebb currents at the site of the proposed dredging at the head of Wallace Channel.

A dike across Wallace Channel on an eastern prolongation of the northern edge of the proposed cut would force through the cut the large quantity of water now passing out through the northern branch as flood flow. It could be carried westward to help concentrate the flood current until the crest of the shoal be passed, and while the deposit of sediment would not be stopped, it would take place in the deepening water on the eastern side of Royal Shoal Harbor, and would be comparatively slow in forming another obstruction to navigation.

11. DIKE MATERIAL.

Oyster shells for dike hearting can be obtained from almost any of the small islands in the vicinity, and probably the north end of Flounder Slough Rock is the best place from which to take them. They are old and very light shells, however, and may be too poor for the purpose, but they could probably be obtained at a low price. The nearest islands consisting of this rock are Flounder Slough Rock and Shell Castle, and both belong to Miss M. M. B. Rodman, of Washington, N. C., whose attorney is Mr. W. B. Rodman, jr., of the same place.

Brush and logs for mattresses can probably be obtained at reasonable prices in the vicinity of the village of Swan Quarter, on the Hyde County shore, about opposite Ocracoke, but I could not obtain more definite information on this point without a special visit to this locality, which I had no chance to make.

12. COMMERCE.

My record of passing vessels shows that between July 23 and October 28 there passed through the inlet 17 inbound and 16 outbound vessels. There were about 13 different vessels, and 8 or 9 of them use the inlet regularly, their round trips taking nearly two months' time apiece, although it is sometimes done in one month.

These schooners when bound out carried average loads of about 100,000 feet of short-leaf pine lumber, occasionally dressed but generally rough; sometimes shingles were carried on deck, but lumber always constituted the bulk of the cargo, except in one instance, when a cargo of naval stores was carried to New York. On the return trips they brought coal, if they could get it, or anything else offered; but they often returned in ballast, and the captains seemed to think that there was little or no money to be made on return cargoes.

Detention.—Outward-bound vessels were detained by insufficient depth at the Swash an average of about three-fourths of a day on each trip, and the detention inside the inlet while waiting for favorable wind and weather averaged eight and one-half days per trip.

Vessels bound in to sound ports generally passed through the inlet without detention, but sometimes had to wait for a favorable tide before they could pass up Teachs Hole Channel. Their average time of detention at the Swash was about one-third of a day per trip.

I would respectfully call attention to the difference between the three-fourths day's detention at the Swash as compared with the eight and one-half days' detention at the inlet. Any work of improvement done at Ocracoke will tend to do away with the former, but the latter depends entirely upon weather conditions. The expenditure of much money does not seem justified when its only object is to save less than one day's time to some 8 or 10 small schooners, especially as they barely pay expenses now and as they must in any case wait inside the inlet for good weather about ten times that length of time per trip.

Ports.—Lumber-laden schooners passing through Ocracoke Inlet are, as a rule, bound to Norfolk, Baltimore, Philadelphia, or New York, or to some intermediate port. Possibly 6 schooners per year pass through the inlet with a cargo of shingles or staves for the West Indies, returning thence with rum or molasses, but the great bulk of the freight consists of short-leaf pine lumber bound north.

Freight rates per 1,000 feet on lumber from sound ports—

Baltimore	$3.00
Philadelphia	3.50
New York	4.50
Long Island Sound ports	4.50
Boston	6.00

These rates are determined entirely by the railroad and canal charges and are probably 30 per cent lower than they were ten years ago.

Insurance rates.—According to information received from lumber shippers at Washington, N. C., insurance rates are as follows: On lumber carried in hold, 1 per cent of value at shipping point; carried on deck, 5 per cent of value at shipping point.

Vessels of the size usually employed in this trade carry about half of their cargo in the hold and half on deck.

Captains of vessels ordinarily passing through Ocracoke Inlet report that it is always easy to make from sea when the weather is clear, and that it is the best inlet between capes Henry and Lookout.

They state that the ease or difficulty of passing Hatteras depends on the currents there prevailing at the time, which are governed entirely by the winds, the two always moving in the same direction. As a rule they do not attempt the passage unless the conditions are favorable, and if unfavorable they await inside the inlets if bound north, and if bound south either anchor in Hatteras Cove or put to sea, according as the wind is light or heavy.

The shoals off Hatteras do not affect these vessels much, as there are only two or three lumps to interfere with a draft of 7 to 8 feet. They therefore generally cross close to shore, and their captains report that during the past few years these shoals have been wearing away and working to the north.

Detention caused by Hatteras Shoals is reported to average one or two days for north-bound vessels, and three or four days for those bound south. The delay to north-bound vessels should include, however, the time of waiting inside the inlets for favorable conditions, which at Ocracoke during my three months' stay there last summer and fall, averaged eight and one-half days per trip. The captains rarely go to sea unless they think they can pass Cape Hatteras the same day before nightfall, and they seem to find Ocracoke village a very pleasant place to wait, particularly if their families live there, as is often the case.

The following information was given me by Capt. John Nelson, who commands the schooner *Cherubim*, which is engaged in the lumber trade through these inlets:

He stated that his ideas on the subject of the improvement of Ocracoke Inlet, as expressed in reply to your circular letter of May 31, 1892, were based on the assumption that not more than 9 feet depth of water was needed at Ocracoke, and for that depth he thought the "Swash" was the best place for dredging, on account of its muddy bottom. He thinks it even doubtful if the place is worth improving at all, as the number of vessels engaged in the trade is small and decreasing. In his opinion the lumber trade through Ocracoke and Hatteras inlets will cease entirely when the few vessels now engaged therein are lost or sold, as the present freight rates are so low that the schooners as a rule barely pay expenses, and often fail to do so. He considers the field for investment such a poor one that it is not likely to attract any fresh capital. He further stated that the schooners could not compete with profit against the railroads and barges for the lumber trade at the present rates; that these rates are determined by the railroad companies, and that the tendency is to make them still lower; also that lumber shipped by rail or barge arrived at its destination in far better condition than that shipped by sailing vessel, as on the latter the deck load was about as wet during the entire trip as it would be if rafted. Comparing the trade at present with that of ten years ago he said that then October rates to Philadelphia were $6 per 1,000 and that now they were only $3.50 per 1,000.

Of the lumber shipped from North Carolina by water during the year 1893 the Albemarle and Chesapeake Canal Company reports that 121,975,900 feet passed through their canal; from my records of last summer and fall I estimate that about 7,500,000 feet is carried out through Ocracoke Inlet each year, and I understand that the amount carried out through Hatteras Inlet is somewhat less. Estimating the latter at 6,500,000 per year, the total for 1893 was about 135,000,000 feet, of which about 90 per cent went through the canal, 5½ per cent through Ocracoke Inlet, and 4½ per cent through Hatteras Inlet. This estimate is for lumber alone, and very little else is carried through the inlets, while lumber constitutes only a part of the freight through the canal. The navigable depths by all three routes being about the same, it is very apparent how much more important the canal route is.

I have learned from many sources that the schooner trade through these inlets has fallen off at least 75 per cent in the last ten years, and after a careful investigation of the matter I am of the opinion that a given amount of capital invested in barges for the lumber trade will yield from eight to ten times the profit that the same amount of capital will yield if invested in schooners for the same purpose, and that with less risk. I therefore conclude that the barge carrying trade is steadily encroaching on that of the schooner, and that the former will before many years drive the schooners from these sounds.

Very respectfully, your obedient servant,

E. W. Van C. Lucas,
First Lieut. of Engineers.

Maj. W. S. Stanton,
Corps of Engineers, U. S. A.

United States Engineer Office,
Wilmington, N. C., April 25, 1894.

Sir: I have the honor to submit the following report of work done at Ocracoke Inlet, North Carolina, in accordance with instructions contained in your letter to me of March 30, 1894.

I left Wilmington April 9, arrived at Washington, N. C., the same evening, and started with my party for Ocracoke the next day on the steamer *Gen. Geo. Thom*, taking the naphtha launch with me in tow. We were detained by stormy weather at and near the mouth of Pamlico River until the afternoon of the 13th instant, when we succeeded in crossing the sound and arrived at Ocracoke the same night. Field work was begun on the 14th instant and vigorously pushed to completion, and on the afternoon of the 18th instant the party left Ocracoke for Newbern and arrived at Wilmington at noon the next day.

There are submitted herewith two inclosures, the first a map plotted to a scale of 500 feet to 1 inch of the three shoals obstructing 9-foot navigation in the Teachs Hole route, the second the plot of a cross section near the head of Wallace Channel, showing the natural side slopes for a mid-channel depth of 9 feet.

The three shoals plotted on inclosure 1 are Cockle Shoal, the "Swash," and Eight Foot Shoal. Cockle Shoal has an average length of 1,055 feet, between 9-foot contours, and crossing it are two channels respectively 175 and 275 feet wide between 7-foot contours, and separated by a lump having but 5¼ feet of water on it. The narrower channel has in its center an 8-foot channel 50 feet wide, and the wider channel has a least depth of 7.8 feet. The mean tide range at this shoal is 0.9 foot.

The "Swash" shoal is 2,650 feet long, between 9-foot contours, and the least depth of 7.3 feet prevails over about half of its entire length. The channel at its narrowest point is 75 feet wide, between 7-foot contours, and the shoal is rendered more difficult of passage by the fact that the currents cross the buoyed passage at nearly right angles, as is shown by the plotted courses of floats run across the "Swash" shoal during ebb and flood tides. The mean tide range at this shoal is about 0.5 feet.

Over the Eight-Foot Shoal the 9-foot channel narrows to a width of 200 feet for a distance of about 200 feet, but the side slopes are so gentle that the width of channel 8.9 feet deep at the same point is fully 600 feet. This shoal is not therefore an obstacle to any vessel able to go to either Washington, Newbern, or Albemarle Sound. This survey shows that the running buoy on Eight-Foot Shoal is about 1,650 feet too far to the east, and that vessels taking the course of N. 35° W. to Bluff Shoal buoy (as indicated on Coast Survey chart, No. 143) will have to run across a point of shoal with about 8.4 feet least depth, instead of having a clear depth of 9 feet or more, as they would have if the buoy were properly placed.

To obtain a clear channel of 9 feet least depth from sound to ocean by the Teachs Hole route would require dredging through Cockle Shoal and Swash Shoal. Such dredging would require the removal of less material than by any other route, but both cuts would be difficult of maintenance. At Cockle Shoal the current would pass directly through a dredged cut, but the constant tendency at that shoal is to wear away the south side of the passage, and even now there is a narrow channel just south of the buoyed channel, which is deeper than the latter, and which must before very long become the main passage. At the Swash Shoal the flood and ebb currents cross the shortest line across it for a dredged cut at angles varying from 60 to 90 degrees, and no cut can be located there that will not be crossed by the currents at angles of 60 degrees or more. It is therefore extremely doubtful if a cut can be maintained through it without constant redredging.

The objections to this route, as regards its directions relative to those of the prevailing winds. have been given in previous reports.

I have found that a clear channel of 9 feet least depth from sound to ocean could be obtained by dredging a cut about 2,100 feet long through the shoal that intervenes between the 9-foot pocket just west of the Swash Shoal and the head of the large branch of Blairs Channel running southwest from the Swash. The 9-foot pocket, the intervening shoal, and the head of the Blairs Channel branch, are all shown on the accompanying map (inclosure 1). A cut through this shoal could be so located as to be in the lines of flow of both flood and ebb currents and in that respect it is an improvement over the Teachs Hole route. As regards the directions of channel lines with reference to the prevailing winds, it is about the same as Teachs Hole route. Although the 9-foot contour from the ocean approaches nearer to that from the sound at the head of this branch, there is but 3 feet of water on the crest of the intervening shoal, which is undoubtedly an objection to dredging through it.

Nevertheless a cut through this shoal would obviate the necessity for either a 5,000-foot cut at the head of Wallace Channel or the cuts through the uncertain shoals of the Teachs Hole route, besides putting out of the question the extremely doubtful shoal at Teachs Hole bar, which, although it has on it over 9 feet of water at present, is liable at any time to shoal to 5 feet or less.

The history of Blairs Channel during the past sixty years, as far as it can be traced from the charts in this office, is given on p. 1374 (top of page) of Report of Chief of Engineers for 1893.

The branch above referred to has not been considered of sufficient importance to plot on the Coast Survey maps, and it was probably not accurately shown until the survey of 1892 from this office.

Below are given the estimates for dredging necessary to obtain 9-foot navigation from sound to ocean by each of the three principal routes, all estimates being based on a channel 9 feet deep and with bottom width of 300 feet:

	Cubic yards.
Teachs Hole route (side slopes 1 on 2):	
Cockle Shoal, length 1,055 feet, least depth 7.8 feet	12,067
Swash Shoal, length 2,650 feet, least depth 7.3 feet	38,043
Total	50,110
Blairs Channel route (side slopes 1 on 20):	
One shoal, 2,140 feet long, least depth 3 feet	97,545.68
Wallace Channel route (side slopes 1 on 40):	
One shoal, 5,000 feet long, least depth 4½ feet	173,123
The same with side slopes of 1 on 1:	
One shoal, etc	126,169

In the Teachs Hole route the depth of cutting would never exceed 2 feet and side slopes are taken as 1 on 2.

In the Blairs Channel route, the average side slope near the head of the branch is 1 on 18, as obtained from 15 different measurements between the 6 and 9-foot contours, and, in estimating, slopes of 1 on 20 are adopted.

In Wallace Channel a careful cross section made near its head showed side slopes of 1 on 40 to 1 on 50 for a mid-channel depth of 9 feet (see inclosure 2), and, in estimating, side slopes of 1 on 40 were adopted.

Current observations in Beacon Island Slough show that at the crest of the shoal the flood current velocity is 40 to 50 per cent greater than the ebb current velocity.

I obtained a large sample of the sand on the crest of Royal Shoal, and as soon as it is thoroughly dry I shall ascertain its specific gravity.

Inquiries among the Ocracoke pilots concerning the ocean currents beyond the outer bar resulted in obtaining the following information: For a distance of 4 miles from the bar the tidal currents from the inlet govern the flow of water, the movement being westerly during flood flow and easterly during ebb flow. Beyond this 4-mile limit littoral currents prevail, and their direction is northerly or southerly, according to the direction of the wind, which also determines their velocity.

Respectfully submitted.

E. W. VAN C. LUCAS,
First Lieut. of Engineers.

Maj. W. S. STANTON,
Corps of Engineers, U. S. A.

Ocracoke Inlet, North Carolina.

Appropriated—	
March 20, 1826, to March 3, 1837	$133, 750. 00
September 19, 1890	90, 000. 00
July 13, 1892	15, 000. 00
Expended fiscal year ending—	
June 30, 1826 to 1837	*133, 732. 40
June 30, 1891	1, 747. 71
June 30, 1892	478. 13
June 30, 1893	5, 128. 15

L 5.

IMPROVEMENT OF FISHING CREEK, NORTH CAROLINA.

Fishing Creek is a tributary to the Pamlico and Tar rivers, which it joins 94 miles above the mouth of the latter in Pamlico Sound.

The project of 1889 is "to clear out its natural obstructions from its mouth up to Bellamy's Mill, at a total expense of about $25,000."

For the reasons given in detail at p. 1377–1380 of the Annual Report of the Chief of Engineers for 1893, no money has yet been expended upon the improvement, and by authority of the Chief of Engineers of June 8, 1893, embodied in that report, the subject was therein reported to Congress for further directions, which are still awaited.

The creek is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1893, balance unexpended	$15, 000
July 1, 1894, balance unexpended	15, 000

Fishing Creek, North Carolina.

Appropriated—	
September 19, 1890	$10, 000
July 13, 1892	5, 000

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* Balance of $18. 60 turned over to surplus fund.

L 6.

IMPROVEMENT OF PAMLICO AND TAR RIVERS, NORTH CAROLINA.

The project, as adopted in 1875, extended in 1879, and again extended in 1889, is to secure by dredging and removal of war obstructions a clear and safe channel 9 feet deep at low water up to Washington, to clear a channel 60 feet wide, 3 feet deep at low water 22 miles farther to Greenville, and 20 inches deep at low water 26 miles farther to Tarboro; to clear the river to its natural dimensions 40 miles farther to Little Falls, 2 miles below Rocky Mount, by removal of war obstructions, snags, logs, stumps, and overhanging trees, at a total final cost estimated in 1891 at $137,200.

A description of the river, a summary of the work accomplished under the foregoing project to June 30, 1893, and a detailed statement of the condition of the channel at that date may be found in the Annual Reports of the Chief of Engineers for 1892, pp. 1118-1120, and for 1893, pp. 1380-1384.

Vessels can carry to the mouth of the river from tide water only 7½ feet at high water over the inner shoals at Ocracoke Inlet from the ocean direct, and only 7 feet, or under exceptionally favorable conditions 8 feet, through the Albemarle and Chesapeake Canal from Hampton Roads when the wind impels water into, and only 6 feet when it impels water from the canal; while 7 feet is all that can be relied upon in going through Croatan Sound, the navigable route from the Pamlico and Tar rivers and Pamlico Sound to Albemarle Sound and to the Norfolk and Southern Railroad at Elizabeth City on the Pasquotank River.

At the foregoing date, June 30, 1893, the only obstructions encountered by vessels in carrying up to Washington the draft of water with which they can reach the mouth of the river, were stumps and logs, the removal of which was then in progress, and was continued until it was suspended because of the depletion of funds, August 2, 1893, since which date no work has been done below Washington. From July 1 to August 2, 1893, 167 stumps, 9 logs, and 2 snags were removed, clearing a length of 500 feet of channel 215 feet wide. From the commencement, November 20, 1892, of the removal of these obstructions, to its suspension, as above, August 2, 1893, 979 stumps, 74 large snags, 1 tree, and 111 logs were removed, clearing 7,200 linear feet (or 1.36 miles) of channel 215 feet wide.

Many marks by propeller blades and by the keels of vessels, found on these obstructions show how detrimental they had been to navigation. One thousand two hundred and fifty linear feet of channel still remain to be cleared, for about 600 feet of which distance, lying within the stumpy area, many obstructions may be expected, while for the remaining 650 feet it is believed they will be found very infrequently. The 7,200 feet already cleared embrace the part where navigation had been most hampered.

The bottom being soft, the obstructions have been removed to a depth of 9 feet below mean low water to facilitate dredging to that depth in accordance with the project, whenever it may become expedient upon that depth being obtained and maintained in the channel over the inner shoals at Ocracoke Inlet.

Between Washington and Greenville, June 30, 1893, the worst obstruction was a shoal at Red Banks, 2 miles below Greenville, where the 3-foot channel at low water (the gauge on the wagon bridge at Tarboro reading +1 foot) was only 35 feet wide, and which considerably curtailed the period annually when steamboats could ascend to Greenville.

From August 5 to November 14, 1893, a longitudinal dike 653 feet in length was built at that shoal, of piles 5 to 8 feet apart with 3-inch sheet piling, at a cost of $1.39 per linear foot, which has so improved the channel that the shoal has ceased to obstruct steamboats.

The steamer *R. L. Myers*, of 83 tons net tonnage, has made triweekly trips between Washington and Greenville throughout the fiscal year, extending them, with few exceptions, 6½ miles above Greenville to Center Bluff, the most important shipping point on the river above Washington, and extending them likewise triweekly to Tarboro from January 1 to June 1, the limits of the period during which the stage of water would permit her to reach the latter point.

The *R. L. Myers* and the steam flatboat *Beta*, which latter runs irregularly between Washington and the cotton-seed oil mills 3 miles above Tarboro, are the only boats running on the river above the sawmill of a lumber company 8 miles above Washington.

Barges laden with lumber are towed from the latter mill down the river, through the sounds and the Albemarle and Chesapeake Canal and Chesapeake Bay to Alexandria, Va., Baltimore and Philadelphia, and one steamer, the *Dennis Simmons*, of 149 tons net, carries lumber from the same mill by the same route to the same ports. Two steamers, the *Alpha* and *Annie*, of 154 and 246 tons net, respectively, carry lumber from a mill on Trantors Creek, 2 miles above Washington, to Baltimore through the sounds, canal, and bay, bringing back to Washington occasional cargoes of freight. The foregoing are all the vessels navigating the river above Washington, except occasionally a small schooner.

The steamers of the Old Dominion Line average throughout the year one round trip weekly between Washington, N. C., and Norfolk. There are also two small steamers plying between Washington and the creeks or landings on the river below.

For maintaining the 48 miles of channel from Washington to Tarboro clear of snags, removing the stumps and logs from the 1,250 feet of channel below Washington, repairing and maintaining jetties and dikes between Washington and Tarboro, and for renewing and maintaining plant, with incidental expenses, the sum of $10,000 can be profitably expended to the close of the fiscal year ending June 30, 1896.

If the depth of 9 feet at mean low water be obtained and maintained in the channel over the inner shoals at Ocracoke Inlet, in accordance with the approved project for improving that inlet, the expenditure, in addition to the foregoing sum of $10,000, of $37,000 will be necessary for dredging 93,000 cubic yards in obtaining, in accordance with the project, a channel 9 feet deep up to Washington, to enable vessels to carry to that port the same draft which they can carry over the shoals at Ocracoke Inlet, if improved, the width of the channel to be dredged up to Washington being 200 feet, in accordance with the estimate on page 1434 of the Annual Report of the Chief of Engineers for 1891.

The work on this river has been done under the immediate supervision of Mr. Charles Schuster, superintendent.

The river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1893, balance unexpended	$3,566.41
June 30, 1894, amount expended during fiscal year	2,922.20
July 1, 1894, balance unexpended	644.21
July 1, outstanding liabilities	119.04
July 1, 1894, balance available	525.17
Amount (estimated) required for completion of existing project	49,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	*10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	3,392	Tar	547
Cotton seed	36	Turpentine, spirits	22
Cotton-seed meal	77	Rosin	90
Cotton-seed oil	314	Peanuts	971
Tobacco	1	Lumber	100,000
Rice	631	Shingles	4,500
Grains	15	Fertilizers	1,600
Vegetables	633	Machinery	1,000
Cattle	12	General merchandise	5,548
Horses	18	Coal and minerals	71
Hogs	1		
Poultry	1	Total	119,505
Oysters	25		

Number of passengers carried, 3,300. Increase since last year, 12,408 tons; transportation lines established, none.

List of steamers navigating the Pamlico and Tar rivers, North Carolina, during the fiscal year ending June 30, 1894.

Name.	Net tonnage.	From—	To—	Number of trips yearly.
Alpha	233	Washington	Norfolk	30
Defiance	350	...do	...do	75
Elko	300	...do	...do	104
R. L. Myers	132	...do	Tarboro	150
Beta	57	...do	...do	Irregular.
Greenville	68	...do	...do	Do.
Aurora	50	...do	Lower Pamlico	150
Gazelle	20	...do	...do	Irregular.
Dennis Simmons	220	...do	Norfolk	Do.
Haven Belle	70	...do	Pungo River	150
Barney *a*	15	On river	On river	Irregular.
E. T. Whitaker *a*	25	...do	...do	Do.
Grace Titus *a*	35	...do	...do	Do.
Albemarle *a*	38	...do	...do	Do.
J. W. Paxton *a*	27	...do	...do	Do.
G. M. Hill *a*	30	...do	...do	Do.
Arm and Hammer *a*	25	...do	...do	Do.
Eckles *a*	50	...do	...do	Do.

a Tugboats.

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* If the depth of 9 feet at mean low water be obtained and maintained at Ocracoke Inlet $37,000, in addition to this $10,000, can be advantageously applied.

Freight transported.

Calendar year ending December 31—	Tons.
1875	21,000
1890	277,832
1891	195,600
1892	107,097

Pamlico and Tar rivers, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838	$10,000	$10,000
Aug. 14, 1876	15,000	15,000
May 3, 1879	6,000	21,000
June 14, 1880	9,000	30,000
Mar. 3, 1881	8,000	38,000
Aug. 2, 1882	10,000	48,000
July 5, 1884	5,000	53,000
Aug. 5, 1886	5,000	58,000
Aug. 11, 1888	10,000	68,000
Sept. 19, 1890	10,000	78,000
July 13, 1892	10,000	88,000

EXPENDED.

To June 30—		To June 30—	
1837 to 1839	$10,000.00	1885	$50,537.10
1877	363.96	1886	52,951.33
1878	12,929.43	1887	56,112.61
1879	14,139.23	1888	57,776.33
1880	20,744.30	1889	64,608.53
1881	29,136.63	1890	66,227.90
1882	35,930.72	1891	68,793.13
1883	39,863.47	1892	75,724.85
1884	45,666.33	1893	84,926.56

L 7.

IMPROVEMENT OF CONTENTNIA CREEK, NORTH CAROLINA.

The Contentnia flows into the Neuse 32 miles above Newbern.

The project, adopted in 1881, is to obtain a depth of 3 feet from the confluence with the Neuse up 63 miles to Stantonsburg, during the higher stages of about nine months' duration annually, by clearing the channel of snags and overhanging trees, by dredging bars, and diking sloughs or outlets, at a cost estimated in 1888 at $77,500.

The stream is described on pp. 1010–1012 of the Annual Report of the Chief of Engineers for 1881. The progress of work under the project to June 30, 1893, and the resulting navigation, are stated on pp. 1385–1386 of the reports, respectively, for 1892 and 1893.

During the fiscal year ending June 30, 1894, the clearing of the 31 miles of channel from the mouth to Snow Hill of snags, logs, stumps, and trees, and of obstructions overhanging from the banks, which had been nearly completed June 30, 1893, was finished by the removal in July of 2 snags, 5 stumps, 6 trees, and 8 logs from the channel and of 2 trees from the banks.

The clearing of the 31 miles of channel from Snow Hill to the mouth, to the variable widths of 60, 80, and 100 feet, and to a depth of not less than 3½ feet when the Snow Hill gauge reads +1 foot, from its commencement in January, 1893 to its completion in July, 1893, cost $6,452, including all expenditures on account of the improvement during that period.

In November the hoister was again sent over the 19 miles of the creek next above its mouth to remove trees that had been carried into it by the gales of August and October, and in November and December removed 30 trees, 12 snags, 3 logs, and 1 stump from the channel and 4 trees from the banks.

In September and October, at the head of Spring Slough 1 mile above the mouth of the creek, a plank dike, 176 feet long, was built across the main channel and was connected through the swamp with the left bank by building an earth dike 440 feet long, and an old earth dike 370 feet long, extending from the channel to the right bank, was repaired by raising it 18 inches with earth and then capping it with logs. These dikes were built and repaired to divert the current into Spring Slough, 2,500 feet long, and through which 1.2 feet greater draft could be carried than through the main channel, notwithstanding efforts had been made to improve the latter by closing its outlets with dikes.

The effect of these dikes has been to deepen Spring Slough about 6 inches, by scouring away the sand down to a mass of roots of the gum and cypress trees in the dense cypress swamp through which the creek there flows and spreads to several times its usual width above the swamp. This mass of roots extends for one-fourth of a mile in the Slough and to within three-fourths of a mile of the Neuse River whose stage of water governs the depth in the swamp and in that part of the Contentnia flowing through it. At that stage of low water in the Neuse, when the Biddles Landing gauge reads +1 foot, and at which the project for the improvement of the Neuse designs to obtain a depth of 4 feet, the depth of water over the surface of roots in the channel of the Contentnia is only about 0.7 of a foot, and to deepen the channel through them would entail expense that would be large in comparison with the commerce of the Contentnia, in which only two boats are engaged, the *Laura* and the *May Belle*, respectively of 14 tons and about 30 tons net, running from Newbern triweekly when the stage of water permits; the former to Snow Hill, 31 miles, and the latter to Hookerton, 21½ miles above the mouth of the creek.

The depth of 3 feet which the project designs to obtain in the Contentnia during the higher stages of about 9 months annually is found on the bars when the stage is at +1.5 feet on the gauge at Snow Hill. By the record of that gauge during 1889 that or a greater depth prevailed 287 days, or 79 per cent of the time; but in 1890 such depth prevailed only 73 days, or 20 per cent of the time.

Since 1888, when a practicable channel was cleared from Snow Hill, 32 miles, to Stantonsburg, there has not been even a pole boat on that part of the river and it does not appear to be in any way useful to commerce to continue the improvement of the creek above Snow Hill, 31 miles from its mouth.

The channel is, June 30, 1894, so far as regards snags, logs, and overhanging obstructions, in good navigable condition for the boats plying on the creek and to so maintain it to June 30, 1896, it is estimated, will cost $7,000.

The creek is in the second collection district of North Carolina.

Money statement.

July 1, 1893, balance unexpended	$3,495.23
June 30, 1894, amount expended during fiscal year	2,809.37
July 1, 1894, balance unexpended	685.86
July 1, 1894, outstanding liabilities	4.30
July 1, 1894, balance available	681.56
Amount (estimated) required for completion of existing project	18,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	7,000.00

Submitted in compliance with requirements of sections 2 of the river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	1,440	Fish	1
Cotton seed	414	Oysters	25
Tobacco	1	Tar	5
Rice	15	Lumber	14,075
Grains	30	Shingles	272
Vegetables	50	Fertilizers	2,275
Cattle	9	Machinery	500
Horses	3	General merchandise	2,056
Hogs	1		
Poultry	1	Total	21,173

Number of passengers carried, 2,000. Increase since last year, 3,682 tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1890	125,225
1891	55,825
1892	17,491

Contentnia Creek, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
Mar. 3, 1881	$10,000	$10,000
Aug. 2, 1882	10,000	20,000
July 5, 1884	5,000	25,000
Aug. 5, 1886	15,000	40,000
Aug. 11, 1888	5,000	45,000
Sept. 19, 1890	7,000	52,000
July 13, 1892	7,000	59,000

EXPENDED.

To June 30—		To June 30—	
1882	$9,693.99	1888	*$39,548.68
1883	19,129.88	1889	43,878.02
1884	20,000.00	1890	43,928.52
1885	23,268.61	1891	48,701.50
1886	24,687.69	1892	49,789.45
1887	34,019.00	1893	56,614.41

L 8.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

In 1879 the project was adopted to obtain a depth of 3 feet at low summer stage from the confluence with the Neuse, at Newbern, 38 miles to Trenton, by dredging to the width of 50 feet through the shoals and removing snags and overhanging trees, at a cost estimated in 1887 at $59,000, and in 1889 the project was extended to clear the river for navigation by small steamboats 33 miles above Trenton, and for pole boats 6½ miles farther to the Upper Quaker bridge, at an additional cost of $13,000; the total estimated cost of improving the 77½ miles being $72,000.

The river is described and the work done (principally in the 14 miles next below Trenton) is summarized on pp. 1125 to 1127 of the Annual Report of the Chief of Engineers for 1892, and the deteriorated condition of the channel immediately below Trenton, and the condition and character of the 39½ miles of the river above Trenton, to which, excepting the lower 4 miles, no money has yet been applied, together with the probable benefits of its improvement, are reported on pp. 1387 and 1388 of the report for 1893.

During the fiscal year ending June 30, 1894, between January 13 and June 15, a channel 20 to 30 feet wide and aggregating 2,085 feet long, through eight shoals of sand in the mile and a quarter next below Trenton, was dredged by a 6-inch pump installed upon a self-propelling scow, the sand being mostly deposited 200 to 300 feet back from the crest of the banks, which varied from 20 to 30 feet in height above the water surface. This channel, which about eight years ago had been dredged to 3 feet and had shoaled to somewhat less than 18 inches, was deepened by this dredging about 16 inches, permitting 2.3 feet to be carried up to Trenton at low water, and enabling the steamer *Howard*, of 42 tons net, the only boat running on the river, to ascend to Trenton with the loss, at most, of but a very few trips annually.

The pump also dredged about 400 cubic yards of sand from the turning basin at Trenton, deepening it to 4 feet, and slight repairs were made to the revetment of its banks.

June 15 to September 4, 1893, the channel between Newbern and Trenton was well cleared of snags, logs, and overhanging obstructions, but late in October the hoister again ascended the river to remove 20 trees lodged in it by the gales of August and that month. During the fiscal year there were removed, between Newbern and Trenton, 529 logs, 353 snags, 77 trees, and 39 stumps from the channel, and 80 overhanging trees from the banks, at a cost, including all expenditures under the appropriation during the time of their removal, of $1,641.82.

In July, 1893, the extension of the Wilmington, Newbern and Norfolk Railroad from Jacksonville on New River 40 miles to Newbern, crossing the Trent at Pollocksville, 18 miles from, and thence paralleling the river to, Newbern, was completed and put in operation to that place.

For widening to 50 feet and deepening to 3 feet the channel through the shoals of sand a little below Trenton, redredging the channel where it has shoaled at several bends, maintaining the turning basin at Trenton, renewal of plant, and maintaining the channel from Newbern to Trenton clear of snags, logs, trees, and overhanging obstructions until June 30, 1896, it is estimated that the sum of $10,000 will be required.

If, under the conditions and circumstances described on p. 1388 of the Annual Report of the Chief of Engineers for 1893, work is, in accordance with the project, to be continued above Trenton 39½ miles to Upper Quaker bridge, the additional amount of $3,000 can be applied June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$5,162.22
June 30, 1894, amount expended during fiscal year	4,449.48
July 1, 1894, balance unexpended	712.74
July 1, 1894, outstanding liabilities	268.37
July 1, 1894, balance available	444.37
Amount (estimated) required for completion of existing project	11,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	880	Tar	116
Cotton seed	163	Turpentine, crude	14
Cotton-seed meal	14	Lumber	30,612
Tobacco	12	Shingles	393
Rice	9	Fertilizers	1,290
Grains	50	Machinery	6
Vegetables	6	General merchandise	1,000
Cattle	6	Coal and minerals	67
Hogs	1		
Poultry	8	Total	34,648
Oysters	1		

Number of passengers carried, 2,000. Decrease since last year, 14,927 tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1878	22,000
1890	80,985
1891	45,000
1892	50,576

Trent River, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
Mar. 3, 1879	$7,000	$7,000
June 14, 1880	10,000	17,000
Mar. 3, 1881	5,000	22,000
Aug. 2, 1882	10,000	32,000
July 5, 1884	10,000	42,000
Aug. 5, 1886	3,500	45,500
Aug. 11, 1888	5,000	50,500
Sept. 19, 1890	5,000	55,500
July 13, 1892	5,000	60,500

EXPENDED.

To June 30—		To June 30—	
1880	$6,871.63	1887	$42,031.73
1881	17,151.43	1888	42,704.98
1882	22,000.00	1889	49,572.38
1883	23,597.38	1890	50,379.41
1884	32,000.00	1891	53,897.07
1885	41,329.56	1892	54,916.78
1886	41,464.06	1893	55,763.02

L 9.

IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

The project of 1871, as modified or extended in 1878, 1879, 1880, and 1883, and continued without modification since the latter date, proposed to remove the war obstructions, to clear the channel up to Smithfield of all snags, logs, and overhanging trees, "and to contract the channelway by jetties so as to assure during the entire year an unobstructed 8-foot navigation 40 miles up to Newbern, and a similar 4-foot navigation 50 miles farther to Kinston, and during nine months of the year a 3-foot navigation 100 miles farther to Smithfield," at a total final cost estimated in 1888 at $374,000.

A description of the river and a brief summary of work upon it by the State of North Carolina in 1856–1857, and by the United States since its commencement in 1878, will be found on pp. 1129–1131 of the Annual Report of the Chief of Engineers for 1892.

From December 22, 1893, to March 3, 1894, there were removed from the channel at Newbern 245 stumps, 68 logs, and 21 snags, enabling vessels drawing 6½ feet of water to ascend to sawmills above the city. April 5 to 27, 92 stumps, 42 snags, and 8 logs, were removed from Flowery Gap Channel leading to the mouth of Bachelors Creek, enabling boats drawing 4 feet to reach the mouth of that creek which they are reported to ascend about 15 miles, and from which they are reported to bring down about 10,000 to 15,000 packages of truck annually, embracing potatoes, peas, beans, other vegetables, and melons; carrying up annually about 300 tons of fertilizer besides merchandise. March 13 to June 21 there were removed from the main channel in the 50 miles between Newbern and Kinston, 240 snags, 100 stumps, 102 logs, 60 trees, and 215 feet of old jetty, and 38 trees were cut and pulled back from the banks.

There have been removed in the aggregate during the year, from the channel 437 stumps, 303 snags, 178 logs, 60 trees, 48 piles, and 215 feet of old jetties, and from the banks 38 trees were cut and pulled back.

Between Newbern and the mouth of the Contentnia, on seven shoals aggregating about 1¼ miles of channel length, and between the mouth of the Contentnia and Kinston, at many short crossings aggregating about 1½ miles in length, the depth is reported less than that prescribed in the project.

Up to Newbern, 40 miles above its mouth in Pamlico Sound, a draft of 8 feet can be carried, and the channel is frequented by steamers and barges plying, one steamer between Newbern and Elizabeth City on the Pasquotank River and the others and the barges between Newbern and Norfolk through the Albemarle and Chesapeake Canal. The route from Newbern to Elizabeth City and Norfolk lies through Croatan

Sound, through which only 8 feet can be carried, and the route to Norfolk continues through the Albemarle and Chesapeake Canal, through which not more than 7 feet can be carried. Seven and one-half feet is all that can be carried from the Neuse through Ocracoke Inlet to the sea. The Neuse has a channel in good navigable condition for boats of 8 feet draft up to Newbern and answering all present demands of navigation up to that city.

From Newbern one steamer, the *Vanceboro*, of 52½ tons, drawing 4 to 4½ feet loaded, runs regularly, when the stage of water will permit, up 50 miles to Kinston, and during high stages 25 miles higher to Whitehall, carrying to the latter point chiefly fertilizers and bringing cotton down. Substantially the sole navigation on the river above the mouth of Contentnia Creek, 31 miles above Newbern, is by the *Vanceboro*.

Parallel with the river on its north bank there is a railroad from Kinston to the Contentnia, and south of the river there is a railroad from Kinston to Newbern.

Two steamers, of about 40 and 14 tons each, run regularly, when the stage of water permits, between Newbern and the Contentnia, while four other steamers, of 18, 30, 40, and 75 tons each, run irregularly between Newbern and Bachelors and Swifts creeks, 8 and 9 miles above it. The foregoing comprise all the navigation on the Neuse above Newbern.

Large quantities of logs are brought down it in rafts, in towing a part of which a tugboat and a launch are constantly engaged.

The maintenance of a navigable channel for light-draft boats from Newbern to Kinston doubtless serves a useful purpose in controlling freight rates by rail.

For obtaining and maintaining the depth of 4 feet from Newbern to Kinston it is estimated that $15,000 can be advantageously expended to June 30, 1896.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1893, balance unexpended	$20, 914. 55
June 30, 1894, amount expended during fiscal year	5, 541. 64
July 1, 1894, balance unexpended	15, 372. 91
July 1, 1894, outstanding liabilities	751. 73
July 1, 1894, balance available	14, 621. 18
Amount (estimated) required for completion of existing project	91, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	15, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	3, 076	Oysters	39
Cotton seed	627	Tar	111
Cotton-seed meal	22	Turpentine, spirits	30
Cotton-seed oil	1	Rosin	460
Tobacco	1	Lumber	34, 401
Rice	20½	Shingles	579
Grain	317	Fertilizer	5, 177
Vegetables	2, 060	Machinery	554
Cattle	14	General merchandise	3, 038
Horses	5½	Coal and minerals	25
Hogs	6		
Poultry	5	Total	50, 573
Fish	4		

Number of passengers carried, 4,215. The foregoing statistics relate entirely to freight carried in bottoms on the river above Newbern.

Freight transported.

Calendar year ending December 31—	Tons.
1877	75, 000
1890	328, 462
1891	267, 650
1892	253, 704

Neuse River, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
June 18, 1878	$40, 000	$40, 000
Mar. 3, 1879	45, 000	85, 000
June 14, 1880	45, 000	130, 000
Mar. 3, 1881	30, 000	160, 000
Aug. 2, 1882	30, 000	190, 000
July 5, 1884	20, 000	210, 000
Aug. 5, 1886	22. 500	232, 500
Aug. 11, 1888	15, 000	247, 500
Sept. 30, 1890	20, 000	267, 500
July 13, 1892	15, 000	282, 500

EXPENDED.

To June 30—		To June 30—	
1879	$29, 321. 11	1887	$220. 040. 38
1880	66, 754. 90	1888	226, 017. 60
1881	105, 134. 05	1889	233, 267. 77
1882	148, 607. 44	1890	245, 498. 43
1883	172, 218. 51	1891	253, 900. 86
1884	184, 137. 03	1892	258, 799. 08
1885	196, 268. 30	1893	262, 535. 42
1886	205, 825. 72		

L 10.

IMPROVEMENT OF INLAND WATERWAY BETWEEN NEWBERN AND BEAUFORT, NORTH CAROLINA, VIA CLUBFOOT, HARLOWE, AND NEWPORT RIVERS.

This waterway, about 18 miles in length across the peninsula between the Neuse River on the north and Bogue and Core sounds on the south, from a point on the Neuse 21 miles below Newbern to Beaufort Harbor, embraces about 15 miles of natural channel improved and maintained by the United States and 2¾ miles of canal at the summit, owned and but poorly maintained by the Albemarle and Chesapeake Canal Company.

The project of 1884 is to obtain a channel 30 feet wide at bottom and 5 feet deep at low water from the Neuse to the 5-foot channel in Newport River which flows into Beaufort Harbor, at a cost, including the completion of the canal, estimated in 1886 at $92,000.

A more detailed description of the waterway and a summary of the work upon it to June 30, 1893, will be found on pp. 1134–1135 and 1393–1394 of the Annual Reports of the Chief of Engineers respectively for 1892 and 1893.

Newbern is an important commercial center connected with Norfolk by a line of steamers through the sounds and the Albemarle and Chesapeake Canal, and by another steamer connecting at Elizabeth City on the Pasquotank with the Norfolk and Southern Railroad. A railroad from Newbern connects at Wilmington with a line of steamers to New York, and another connects at Goldsboro with the Atlantic Coast Line Railroad.

The waterway is, therefore, very useful to the region bordering Bogue and Core sounds for the transportation in sharpies or other small crafts of produce direct to Newbern without rehandling and of merchandise in the other direction, and in affording competition between Beaufort Harbor and Newbern with the Atlantic and North Carolina Railroad, a controlling interest in whose stock is owned by the State.

Since 1890 dredging to obtain the depth of 5 feet prescribed in the project has been suspended to await the deepening of the canal by the company owning it or its cession to the United States, and work has been restricted to maintaining in the natural parts of the route a channel clear of logs to the depth of water that there is in the canal, which is 2 feet at ordinary low water and 3 feet at ordinary high water.

The failure of the canal company, not only to maintain a greater depth but to keep even the present depth cleared of logs, is a serious hindrance to the considerable number of small vessels that pass through the waterway annually.

During the months of May and June, 1893, there passed in both directions 169 boats having a total tonnage of 1,732 tons; 51 boats whose tonnage was not given, and 8 rafts of logs, and during May, 1894, 115 vessels with a total tonnage of 1,053 tons, 77 with tonnages unknown, and 8 rafts of logs passed in both directions.

No work has been done upon the waterway during the fiscal year ending June 30, 1894, the money expended having been applied to inspection and to paying the services of the traffic observer.

The waterway is in the collection district of Pamlico and Beaufort, N. C.

Money statement.

July 1, 1893, balance unexpended	$7,711.18
June 30, 1894, amount expended during fiscal year	199.06
July 1, 1894, balance unexpended	7,512.12
July 1, 1894, outstanding liabilities	32.60
July 1, 1894, balance available	7,479.52
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	57,000.00

COMMERCIAL STATISTICS.

Freight transported.

Calendar year ending December 31—	Tons.
1890	14,000
1891	17,390

Inland waterway between Newbern and Beaufort, N. C.

APPROPRIATED.

Date.	Amount.	Aggregate.
Aug. 2, 1882	$10,000	$10,000
Aug. 5, 1886	10,000	20,000
Aug. 11, 1888	15,000	35,000

EXPENDED.

To June 30—		To June 30—	
1884	$194.40	1889	$21,242.45
1885	2,074.31	1890	26,603.12
1886	2,205.76	1891	27,079.40
1887	3,499.25	1892	27,130.98
1888	6,812.45	1893	27,416.46

L II.

IMPROVEMENT OF HARBOR AT BEAUFORT, NORTH CAROLINA.

The project of 1881, as modified in 1887 and 1890, is to stop the erosion of Fort Macon and Shackleford points by jetties, to prevent the widening and shoaling of the entrance to the harbor, and to dredge a channel 100 feet wide and 7 feet deep from the bulkhead channel, a distance of about 1,950 feet, to the wharves at Beaufort.

A description of the harbor and a summary of the work to June 30, 1893, under the foregoing project, together with the several modifications of the project, will be found on pp. 1137–1139 and on p. 1395 of the Annual Reports of the Chief of Engineers, respectively, for 1892 and 1893.

While the preservation of Fort Macon and Shackleford points is important and essential to the preservation of the entrance to the harbor proper, consisting chiefly of the bold channel 1¾ miles in length from Fort Macon Point to the terminus of the Atlantic and North Carolina Railroad at Morehead City, the channel that was to be improved by the dredging prescribed in the project is a minor one leading to the wharves of Beaufort, a town of 2,000 inhabitants. The Bulkhead Channel, which the dredged channel thus connected with the wharves at Beaufort, is, at its junction with the main channel of the harbor, obstructed by a shoal upon the crest of which in the channel the depth at mean low water was 5.6 feet June 30, 1893, and is 5.3 feet June 30, 1894. The mean rise of tide is 2.8 feet, and the depth at mean high water is, therefore, 8.1 feet. The channel which was dredged to the wharves is, therefore, now accessible only by a channel in which the depth is 1.7 feet less than that obtained by dredging. The distance across this obstructing shoal from the 7-foot contour in the main channel to the 7-foot contour in the Bulkhead Channel was 300 feet in June, 1890, 400 feet in June, 1892, and is 850 feet in June, 1894.

As shown on pp. 1459–1460 of the Annual Report of the Chief of Engineers for 1893, by a comparison of charts from surveys made in 1854, 1864, 1874, and 1887, Bird Island Shoal, within this harbor, very materially increased in extent between those dates, increasing in length about 2,000 feet easterly, more than doubling in width at its easterly end, and diminishing the minor channel north of it from a width of 1,000 yards and depth of 4 feet in 1854 to a width of 100 yards and depth of 6 inches in 1887. This shoaling would seem to be ascribable to the larger volume of sand borne in by the seas that surge through the inlet from the ocean than the ebb currents can bear back again.

While by far the most marked accretion has been to the east of Beaufort, Shark Shoal (see chart facing p. 1396, Annual Report Chief of Engineers for 1893) is reported to have been for several years extending southeasterly and encroaching on the Bulkhead Channel, its prolongation across that channel being the bar which obstructs the latter. During the past two years, when the deterioration of the channel across this bar has been more noticeable, the southeasterly 1,500 feet of Shark Shoal that are above low water have been eroding.

The growth of this bar at the entrance of the Bulkhead Channel, between Bird Island Shoal and Shark Shoal, seems to have been of very long continuance, for the channel depth on it in 1874 was, by the Coast Survey Chart of 1876 (No. 420), 9½ feet at low water where it is now only 5.3 feet. The tendency seems to be to unite those two shoals, forming a continuous one 3½ miles long from the extremity of Bird Island Shoal on the east to the extremity of Shark Shoal on the west.

As an attempt to arrest this deterioration of the Bulkhead Channel by a regulation work would be expensive and unpromising, pursuant to a recommendation submitted through the Division Engineer to the Chief of Engineers May 8, and approved by them May 9 and 10, 1894, the deterioration will be retarded by dredging with a sand pump belonging to the United States plant.

During the fiscal year ending June 30, 1894, seven jetties of brush and stone, aggregating 688 feet in length, have been built to arrest the erosion of the inner (northerly) shore of Shackleford Point, commencing about 1,350 feet east and extending to about 1,850 east from the westerly end of the concrete jetty; on Fort Macon and Shackleford points 2,384 lineal feet of sand fences have been built, 1,328 feet repaired, 4,378 feet raised, and 21,548 feet filled under and refilled under with sand. To protect the dumpage bank along the dredged channel 150 linear feet of oyster-shell dike have been built and marsh grass transplanted.

The channel on the bar at the entrance to this harbor is so changeable, both in position and depth, no soundings are shown on the Coast Survey Chart.

According to information, courteously furnished by Capt. Gabrielson, of the U. S. revenue cutter *Colfax*, the greatest draft that can be carried over the bar at low water is 12 feet in June, 1894.

The bar channel is now wider and more favorable in its direction than it has been for some years past.

The surveys and work in this harbor during the year have been under the immediate supervision of Mr. W. H. Chadbourn, jr., assistant engineer.

Beaufort is a port of entry.

Money statement.

July 1, 1893, balance unexpended	$12,736.63
June 30, 1894, amount expended during fiscal year	2,977.09
July 1, 1894, balance unexpended	9,759.54
July 1, 1894, outstanding liabilities	365.65
July 1, 1894, balance available	9,393.89
Amount (estimated) required for completion of existing project	13,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	250	Turpentine	13,500
Cotton seed	87	Lumber	16,000
Rice	21	Shingles	860
Grains	150	Fertilizers	500
Vegetables, including truck	250	General merchandise	12,500
Fish	4,000	Coal and minerals	250
Oysters	10,000		
Clams	4,500	Total	62,913
Tar	45		

Number of passengers carried, 10,000. Gain over last year, 7,843 tons. Transportation lines established, none.

Freight transported.

Calendar year ending December 31—	Tons.
1880	25,000
1890	46,675
1891	69,330
1892	55,070

Harbor at Beaufort, N. C.

APPROPRIATED.

Date.	Amount.	Aggregate.
July 4, 1836	$5,000	$5,000
Mar. 3, 1880	30,000	30,000
Aug. 2, 1882	25,000	55,000
July 5, 1884	20,000	75,000
Aug. 5, 1886	15,000	90,000
Aug. 11, 1888	35,000	125,000
Sept. 19, 1890	15,000	140,000
July 13, 1892	10,000	150,000

EXPENDED.

To June 30—		To June 30—	
1837	$5,000.00	1887	$83,086.19
		1888	88,869.48
1882	4,102.91	1889	101,972.62
1883	37,930.61	1890	122,034.43
1884	43,801.04	1891	123,673.31
1885	72,781.44	1892	128,355.31
1886	75,000.00	1893	137,422.37

L 12.

IMPROVEMENT OF INLAND WATERWAY BETWEEN BEAUFORT HARBOR AND NEW RIVER, NORTH CAROLINA.

The project was approved in 1885, and is to dredge a channel 100 feet wide and 3 feet deep at low water through the shoals six in number and aggregating about 4 miles in length in Bogue Sound which extends from Beaufort Harbor nearly the whole 28 miles to Swansboro, at a cost estimated in 1887 at $50,000.

The other 22 miles of the waterway, consisting of sinuous, and in places very narrow and very shallow, tidal channels winding through the marsh which extends from Swansboro to New River, between the mainland on the one hand and the outlying barrier beach on the other, are not embraced in the project.

A description of the waterway, the location of the several shoals, and the progress of work under the project to June 30, 1892, will be found on pp. 1141-1143 and pp. 1397, 1398 of the Annual Reports of the Chief of Engineers for 1892 and 1893.

To June 30, 1892, a channel had been dredged through all the shoals between Beaufort and Swansboro, an aggregate length of 4.12 miles, of widths as follows: One hundred feet wide though one shoal 980 feet long; 40 feet wide through three shoals aggregating 3.45 miles in length and 60 feet wide at two localities aggregating 2,855 feet in length.

The commerce of the sound in 1892 was carried in sharpies and other very light-draft sailing craft and by one light-draft steamer of 54.81 tons for which the foregoing channel appeared adequate both in width and depth. A recommendation was therefore submitted to the Secretary of War and approved by him August 4, 1892, that the $10,000 appropriated July 13, 1882, "be withheld and that no further expenditure on this work be made until experience shall show whether it be necessary."

White Oak River flowing into the sound at Swansboro traverses a quite extensive tract of timber land. The annual output from a sawmill on this river is about 6,000,000 feet of lumber which mostly hitherto has been loaded on schooners at the mouth of the river and shipped by sea through Bogue Inlet nearly opposite the mouth at Swansboro; but the channel on the bar at the inlet is constantly shifting in depth and position and has usually not more than 5½ feet at mean low water, the rise and fall of the tide being 3.8 feet. By transit through the sound to a well-equipped planing mill which is situated alongside both the deep-water channel in the easterly end of the sound leading to Beaufort Harbor and the track of the Atlantic and North Carolina Railroad Company at Carolina City, this lumber has the advantage of two lines to Northern markets, by railroad and by vessel from Beaufort Harbor whose bar, although changeable, has now 12 feet at mean low water.

To take advantage of these two lines of transport the attempt has been made since the improvement of the channel in the sound to ship much the larger part of this 6,000,000 feet of lumber through the sound to Carolina City, and the deeper draft of the craft carrying it than those hitherto navigating the sound has revealed the fact that the survey of 1887 and the 4.18 miles of channel dredged to June, 1892, did not embrace the entire length of channel in the sound where there is less than 3 feet of water at mean low tide. The depth in the channel is less than 3 feet for a distance of 1,112 feet westward from the westerly end of Sanders Creek Cut, and for a distance of 815 feet between the two northerly cuts at Turtle Slough; while the 3-foot channel is only 40 feet wide for a distance of 150 feet southerly from the southerly end of the middle cut at Turtle Slough. The whole distance where the depth is a few inches less than 3 feet aggregates 1,927 feet.

Another sawmill has recently been built at Swansboro and it is probable that this lumber traffic is now as important as all other commerce on the sound.

The transit of lumber is much hampered at the above shoal localities and 60 feet is the width of channel necessary to accommodate it.

It was therefore recommended January 30, 1894, that the $10,000, less amount expended for surveys, be applied to dredging a channel 60 feet wide along the 1,927 feet where the depth is less than 3 feet. This recommendation having been approved by the Chief of Engineers February 3, March 10, 1894, proposals were opened for dredging in accordance therewith, which dredging was awarded to the lowest bidder, B. F. Hipple, of Philadelphia, at 33⅓ cents per cubic yard. Although contract was sent him for signature March 29 he did not, although twice written to for it, return it to this office until May 12, but with a defective bond which was immediately sent back to him for correction, but which, notwithstanding two requests, he has not yet returned. Mr. Hipple has therefore failed to satisfactorily enter into the contract at the expiration of three months after it was sent to him for signature.

For widening to 60 feet, with the depth hitherto dredged, the 3.45 miles of channel that have been dredged to a width of 45 feet, $8,500 could be applied to June 30, 1896, but such application is not recommended for the reason that the depth of 3 feet at mean low water, to which the project now restricts the dredging, is inadequate for the lumber traffic for which the depth of 4½ feet at low water is necessary, and if Congress order a preliminary examination with a view to obtaining 4½ feet and sanction that depth, dredging the channel twice over, first to 3 feet and afterwards to 4½ feet, would greatly increase the ultimate cost.

Other than the surveys made of the shoal locality in the channel by Mr. W. H. Chadbourn, jr., assistant engineer, August to October, 1893, no work has been done during the fiscal year.

The waterway is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1893, balance unexpended	$9,700.17
June 30, 1894, amount expended during fiscal year	945.36
July 1, 1894, balance unexpended	8,754.81
July 1, 1894, outstanding liabilities	10.30
July 1, 1894, balance available	8,744.51

Amount (estimated) required for completion of existing project $10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896 8,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging waterway between Beaufort Harbor and New River, North Carolina, received in response to advertisement dated February 10, 1894, and opened at 11 o'clock a. m., March 10, 1894, by Maj. W. S. Stanton, Corps of Engineers, U. S. Army.

No.	Name and address of bidder.	Price bid per cubic yard in situ.	Remarks.
		Cents.	
*1	Virginia Dredging Company, Richmond, Va.	34	Contingent upon the Roanoke River dredging.
2	B. F. Hipple, Philadelphia, Pa.	$33\frac{33}{100}$	Independent of the Roanoke River dredging.

* Informal, inasmuch as there is no guarantee, and the evidence of the president's authority to execute the same is not furnished, nor is the seal of the company attached.

Recommended that award be made to No. 2, B. F. Hipple, Philadelphia, Pa.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	150	Clams	960
Cotton seed	85	Tar	45
Rice	21	Turpentine, crude	13,500
Grains	20	Lumber	13,500
Hogs	7	Shingles	800
Fish	1,000	General merchandise	2,500
Oysters	50		
		Total	32,638

Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1886	12,250
1890	29,332
1891	30,240

Inland waterway between Beaufort and New River, N. C.

APPROPRIATED.

Date.	Amount.	Aggregate.
Aug. 5, 1886	$10,000	$10,000
Aug. 11, 1888	5,000	15,000
Sept. 19, 1890	15,000	30,000
July 13, 1892	10,000	40,000

EXPENDED.

To June 30—		To June 30—	
1887	$410.57	1891	$19,504.81
1888	6,676.51	1892	29,951.74
1889	14,595.06	1893	30,299.83
1890	14,637.89		

L 13.

IMPROVEMENT OF INLAND WATERWAY BETWEEN NEW RIVER AND SWANSBORO, NORTH CAROLINA.

This waterway is a sinuous tidal channel about 22 miles long and in places very narrow and shallow, winding through a marine marsh extending from Swansboro to New River, and is fully described on p. 1146 and pp. 1399, 1400 of the Annual Reports of the Chief of Engineers respectively for 1892 and 1893.

The project adopted in 1889 is to enlarge it by dredging to a minimum width of 40 feet and minimum depth of 4 feet at mean high water, at an estimated total cost of $43,000.

For the reason that an act of the general assembly of North Carolina, ratified February 13, 1889, incorporated the Wrightsville and Onslow Navigation Company with the exclusive right to navigate this waterway, as set forth in House Ex. Doc. No. 26, Fifty-second Congress, first session (p. 1147 of the Annual Report of the Chief of Engineers for 1892), no work has been done under the project, or since the survey of the route in April and May, 1891.

The waterway is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1893, balance unexpended	$4,382.25
June 30, 1894, amount expended during fiscal year	2.25
July 1, 1894, balance unexpended	4,380.00
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	38,000.00

Inland waterway between New River and Swansboro.

Appropriated September 19, 1890	$5,000.00
Expended fiscal year ending June 30, 1891	509.76
Expended fiscal year ending June 30, 1892	133.75
Freight transported, calendar year ending December 31, 1891.......tons..	3,000

L 14.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

This river is described and a summary of the work for its improvement given on pp. 1149 and 1150, and pp. 1400, 1402 of the Annual Reports of the Chief of Engineers for 1892 and 1893, respectively.

In undertaking the improvement the purpose was to obtain a channel

4 feet deep from that depth of water in the channel below to that depth in the channel above Cedar Bush Marsh, about 1½ miles above the river mouth, by dredging a straight cut 5,800 feet long through the marsh to replace the circuitous natural channel about 7,000 feet long around the marsh, the depth in the natural channel at mean low water being then as now not less than 4 feet from the ocean up 23 miles to Jacksonville, except at one locality in the circuitous channel around the marsh where, within a distance of about 1,300 feet, there are two very short shoals of sand upon which the depth is only about 3 feet.

Above the marsh the depth of the channel in places exceeds 4 feet by but a few inches.

The cut that was accordingly dredged through Cedar Bush Marsh in 1886 to 1888 shoaled at its extremities (as shown on sheet 2, between pp. 1402 and 1403 of the Annual Report of the Chief of Engineers for 1893), notably at its upper end, so as to be impassable with a draft of more than about 18 inches at low water. The natural depth in the river at that extremity of the cut is so little in excess of 4 feet it was apparent that the cut could be maintained only by repeated redredging and its abandonment was directed by the Chief of Engineers May 17, 1893, who at the same time required further consideration of the subject with a view to ascertaining the relative advantage of dredging another cut through the marsh near the present Dudley Cut, or of improving the circuitous natural channel around the marsh.

In October and November, 1893, a further survey was made and current observations were taken for this purpose by Mr. W. H. Chadbourn, jr., assistant engineer.

To dredge a new cut through the marsh, involving the risk of getting a dredging plant to so isolated a locality, it is estimated from that survey would cost about $10,000. As the straight cut dredged through the marsh had soon become obstructed and useless by the formation of a shoal in the river immediately at its upper end, so likewise is noticeable an especially shoal area in the river immediately at the upper end of Dudley Cut, which is a natural channel, and like obstruction by shoaling at the upper end of any cut that could be made through the marsh is apprehended. The dredging of another cut was, therefore, not recommended.

The current observations taken October and November in the circuitous natural channel around the marsh show that while the ebb current follows the continuous but obstructed channel, the flood current sets up into a deeper but blind channel apparently scoured by the southeasterly gales; the discordant direction and action of the ebb and flood causing the short shoals of sand which obstruct the channel. The range of the tide there is only about 0.4 of a foot, and the currents are much influenced by the wind.

It was therefore recommended, June 11, 1894, that the improvement and maintenance of the natural channel around the marsh to the depth of 4 feet be attempted by building a training work of piles and sheet piling to close the blind channel and deflect the flood current into the same channel with the ebb, inducing enough scour to maintain the depth of 4 feet after obtaining it by dredging, and avoiding, if possible, by leaving the training work more or less open, so much scour during southeasterly gales as to re-form the shoal immediately above it. The cost of the training dike and dredging is estimated not to exceed $5,000. Piles are reported in that locality to withstand the ravages of the teredo about five years. This recommendation was approved by the Chief of Engineers June 18, 1894.

The project as thus modified June 18, 1894, and as previously modified August 9, 1892, is, therefore, to leave the width of the cut through Wrights Island (between the marsh and the river mouth) as at the latter date, namely, about 100 feet, and to obtain by a training dike and by dredging a channel 4 feet deep through the shoals of sand obstructing the circuitous natural channel around Cedar Bush Marsh.

The total estimated cost by the project of 1885 of dredging a cut 150 feet wide and 5,710 feet long through the marsh, and of the same width about 1,200 feet long through Wrights Island, was $40,000.

The channel on the ocean bar at the river mouth is very changeable, both in position and depth, which latter has for a number of years seldom exceeded 5 feet at low water, until in the southeast gale of October last a new inlet was cut through the beach about 1,300 feet east of the location of the inlet when the gale commenced.

This new inlet, through which pilots report 7 feet can now be carried at low water, is almost in alignment with the straight cut dredged through Wrights Island about 2,000 feet within the inlet.

Since this inlet was cut the depth has increased on the shoals which had formed at each end of the Wrights Island Cut and had obstructed it (as shown on sheet 1, facing p. 1402 of the Annual Report of the Chief of Engineers for 1893), so that now 4 feet at low water can be carried over both shoals and through the cut, while the natural channel around Wrights Island has continued deteriorating so that not more than 2½ feet can now be carried through it. In February, 1893, fully 4 feet at low water could be carried through this rapidly narrowing natural channel around the island, while only 3 feet could be carried over the shoals at each end of the cut through it. Owing probably to the new inlet formed nearly in alignment with the Wrights Island Cut, that cut is now available to navigation for vessels drawing 4 feet.

When the improvement was projected in 1882 the only outlet for the products of the vicinity was by the river or by wagon, and 7 schooners, said to have averaged in size about 18 tons, are reported to have been at that time plying between the river and Wilmington.

In 1891 a railroad, 50 miles long, was completed and put in operation from Wilmington to New River, and in 1893 it was extended and put in operation 40 miles farther to Newbern, so that there are now direct outlets by rail from New River to those ports, and the river is now navigated only by two or three small vessels which encounter difficulty or delay only at the shoals of sand embraced within the 1,300 feet of channel where the training dike is to be built.

The river is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1893, balance unexpended	$12,557.65
June 30, 1894, amount expended during fiscal year	1,083.97
July 1, 1894, balance unexpended	11,473.68
July 1, 1894, outstanding liabilities	87.31
July 1, 1894, balance available	11,386.37
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	7,000.00

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	38	Clams	2
Cotton seed	2	Turpentine, spirits	30
Tobacco	2	Rosin	120
Rice	1½	Shingles	50
Grains	1	Fertilizers	80
Vegetables	33	Coal and minerals	11
Poultry	2	General merchandise	463
Fish	233		
Oysters	66	Total	1,134½

Number of passengers carried, 950. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1882	5,000
1890	17,850
1891	23,838

New River, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838		$50,000
August 2, 1882	$5,000	5,000
July 4, 1884	5,000	10,000
August 5, 1886	10,000	20,000
August 11, 1888	3,000	23,000
September 19, 1890	5,000	28,000
July 13, 1882	5,000	33,000

EXPENDED.

To June 30—		To June 30—	
1837 to 1839	*$48,833.54	1889	$18,532.49
1886	9,810.24	1890	19,188.18
1887	9,992.04	1891	19,088.03
1888	18,183.41	1892	19,780.15
		1893	20,442.35

L 15.

IMPROVEMENT OF NORTHEAST (CAPE FEAR) RIVER, NORTH CAROLINA.

This river and the character of its traffic are described on pp. 1152 and 1153, and pp. 1403 and 1404 of the Annual Reports of the Chief of Engineers for 1892 and 1893, respectively.

The project approved in 1889 is to thoroughly clear a channel of good width and natural depth for small light-draft steamers up to Hallsville, about 88 miles above the confluence of the Northeast with the main Cape Fear River at Wilmington, and for pole boats up, about 15 miles farther, to Kornegays bridge.

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* Balance of $1,166.46 turned over to surplus fund.

The river is navigated exclusively by pole boats of 30 to 50 tons capacity, which ascend at freshet stages to Kornegays bridge, 103 miles above the confluence, carrying up merchandise and fertilizers and bringing down naval stores and some agricultural products. These pole boats are towed by small tugboats of about 8 tons capacity, drawing 3 feet, up to Bannermans bridge, 48 miles above the confluence, at all tides and stages of water, and to Big Pitch Kettle, 54 miles above the confluence, where there is a rocky bar at ordinary high lunar tides at any stage of the river. Above that point the river is so shallow, navigation, even by flat pole boats, is practicable only during freshet stages, there being frequently between the freshets only a few inches of water on the bars.

There has been little work to do under the project below Big Pitch Kettle, but above that point the river was much choked with logs, snags, stumps, and trees.

During the fiscal year ending June 30, 1894, work was first resumed December 19, 1893, at Hallsville, 88 miles above the confluence, to which the hoister was towed December 18. To February 28, 1894, she had, in descending, cleared the channel down 18½ miles to Coxs Bluff, up to which point the channel had been cleared, when work was suspended there February 27, 1893.

March 8, 1894, the hoister again ascended to Hallsville, where it resumed work in ascending the river, which was much choked with obstructions, and to June 30 had cleared the channel to a point 11¼ miles above Hallsville, 99¾ miles above the confluence and only 3¾ miles below Kornegays bridge, the upper limit prescribed in the project.

During the fiscal year the channel for a width of 50 feet, and to the full depth of water on the bars, has been cleared from Coxs Bluff up 29¾ miles to Miller's Landing by the removal of 1,316 logs, 882 snags, 461 stumps, and 268 trees, and 229 trees and 19 logs have been removed from the banks.

This work has cost, including all expenses during its progress, $107.50 per mile. It has been considerably retarded during the past two months by the low stage of water, during a considerable part of which time the hoister has been aground and the work restricted to such as could be done by the men upon the banks.

The sum of $1,500 should be appropriated for the maintenance of the cleared channel to June 30, 1896.

The river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1893, balance unexpended	$4,925.85
June 30, 1894, amount expended during fiscal year	2,925.91
July 1, 1894, balance unexpended	1,999.94
July 1, 1894, outstanding liabilities	272.22
July 1, 1894, balance available	1,727.72
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	41	Rosin	2,790
Grains	10	Lumber	25,410
Fertilizers	45	Shingles	400
Tobacco	1	Bricks	3,000
Tar	745	General merchandise	7,400
Turpentine, crude	58		
Turpentine, spirits	488	Total	40,388

Increase since last year, 2,959 tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1890	40,596
1891	30,295
1892	37,429

Northeast (Cape Fear) River.

APPROPRIATED.

September 19, 1890	$5,000.00
July 13, 1892	5,000.00

EXPENDED.

To June 30—	
1891	$3,173.60
1892	3,843.71
1893	5,074.15

L 16.

IMPROVEMENT OF BLACK RIVER, NORTH CAROLINA.

This river, which flows into the Cape Fear River 14½ miles above Wilmington, is described and the record of its improvement by an incorporated company and by the United States is given on pp. 1154–1157 and 1407–1410 of the Annual Reports of the Chief of Engineers for 1892 and 1893.

The project of 1885, as modified in 1893, is to apply at least $10,000 to removing logs, snags, and overhanging trees from the bed and banks of the river and rounding off a few of the sharper bends, from its confluence with the Cape Fear River up 64 miles to Clear Run bridge.

July 1, 1893, the clearing of the channel, which had commenced at Clear Run March 7, had progressed to a point 18 miles below Clear Run, and was continued until September 6, 1893, when it was completed at Point Caswell, 22 miles above the confluence, the 42 miles of channel from Clear Run to Point Caswell having been cleared in six months at a cost, including all expenditures under the appropriation during that time, of $7,474.53, being $177.95 per mile.

The channel was cleared to the width of 40 feet in the straight reaches, to the full natural width in the narrow bends, and in wide bends to the full width between the contours at the depth to which the snagging was carried.

In October and November the hoister again ascended the river to remove the trees and obstructions carried into it by the severe gales of August and October.

During the fiscal year 24 miles of channel were cleared to the above depth and widths, by the removal of 461 logs, 362 snags, 258 stumps, and 129 trees.

In the 28 miles next above Point Caswell there are three localities known as Goff's, Haws, and South River Narrows, the former 2 miles and the two latter each 4 miles in length, where the natural channel is very narrow, crooked, and shallow, the water spreading through cypress swamps.

The channel is, June 30, 1894, well cleared of snags, etc., and navigation unimpeded, except at those three localities.

The sum of $3,000 should be appropriated for the maintenance of the cleared channel to June 30, 1896.

The commercial statistics for this river have been compiled with much labor and completeness by Mr. Henry J. Clark, of this office, who obtained from the steamboat company all their shipping ledgers, six in number, from which he extracted every item of produce and merchandise shipped up and down the river during the year.

The river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1893, balance unexpended	$6,456.33
June 30, 1894, amount expended during fiscal year	4,130.15
July 1, 1894, balance unexpended	2,326.18
July 1, 1894, outstanding liabilities	4.85
July 1, 1894, balance available	2,321.33
Amount that can be profitably expended in fiscal year ending June 30, 1896, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	63	Tar	1,007
Cotton seed	2½	Turpentine, crude	1,021
Tobacco	9	Turpentine, spirits	651
Rice	21½	Rosin	4,857
Grains	286	Lumber	24,126
Vegetables	15	Shingles	4,555
Cattle	96	Fertilizers	357
Horses	2	Machinery	255
Hogs	25	General merchandise	7,632
Poultry	15		
Fish	5	Total	45,003
Oysters	2		

Number of passengers carried, 1,373. Decrease since last year, 11,048 tons; transportation lines established, none.

Freight transported.

Calendar year ending December 31—	Tons.
1885	48,650
1890	61,311
1891	79,429
1892	56,061

Black River, North Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
August 5, 1886	$3,000	$3,000
July 13, 1892	10,000	13,000

EXPENDED.

To June 30—	
1887	$42.70
1888	2,267.31
1889	2,377.24
1890	2,896.85

To June 30—	
1891	$2,997.40
1892	3,000.00
1893	7,874.57

L 17.

IMPROVEMENT OF CAPE FEAR RIVER ABOVE WILMINGTON, NORTH CAROLINA.

The river above Wilmington is 115 miles in length to Fayetteville, the practical head of navigation, 149 miles above the mouth.

The project of 1881, as matured in 1885 and 1886, is to secure "at all times of the year" a depth of 4 feet from Wilmington 73 miles to Elizabethtown and of 3 feet thence 42 miles to Fayetteville, by the removal of snags, logs, stumps, and rock, and of overhanging trees from the banks, by the building of 84,000 linear feet of rock jetties, and by a small amount of dredging, at a total cost estimated in 1893 at $275,000.

A description of the river and a résumé of the work accomplished for its improvement will be found on pp. 1158–1163 and pp. 1411–1417 of the Annual Reports of the Chief of Engineers, respectively, for 1892 and 1893, together with a summary in the latter report (p. 1416) of the amount of work, approximately, remaining to be accomplished.

During the fiscal year eleven jetties of brush and stone aggregating 1,277 feet in length were built on the two worst shoals in the river, namely, Old Ferry Shoal, 9 miles below Fayetteville, and Little Sugar Loaf Shoal, 49½ miles below Fayetteville upon which the least channel depths at low water were, respectively, 1.2 and 2.6 feet. Upon the former seven jetties were built, having a total length of 818 feet, and upon the latter four jetties, having a total length of 460 feet. The masters of steamers running on the river report that since these jetties were built those shoals have ceased to trouble them at low water.

February 19, the water being too high to continue it advantageously, work upon the jetties was suspended and the balance of the funds available reserved for snagging.

The hoister for the latter work belongs jointly to and is used in rotation upon this, the Black, and North East Cape Fear rivers, and has been employed on the two latter during the greater part of the fiscal year. It is, June 30, descending the North East Cape Fear, en route to this river, where snagging is needful and will be at once commenced.

By a line of levels run in May and June by Mr. S. F. Burbank the zero of the gauge at Elizabethtown was found to be 10.64 feet below the zero of the gauge at Fayetteville.

The river from Fayetteville to Elizabethtown is 41.6 miles long, and contains 28 shoals, upon which the aggregate channel length that has been improved and is to be improved is 13.3 miles, or 32 per cent of the whole distance.

The difference in level of the water surface at Fayetteville and Elizabethtown at low stage in 1891 and 1892 was as follows:

	Fayetteville gauge.	Elizabethtown gauge.	Total fall.	Slope per mile.
	Feet.	*Feet.*	*Feet.*	*Feet.*
Mean low water, 1891	4.96	2.07	13.53	0.325
Mean low water, 1892	2.88	.41	13.11	.315
Dead low water, 1892	1.1	—1.2	12.9	.310

Three steamers, the *Murchison*, *Cape Fear*, and *A. P. Hurt*, ply upon the river between Wilmington and Fayetteville, running two at a time in rotation.

From the published rates of the Associated Railways of Virginia and the Carolinas, corrected to January 12, 1894, as taken from the bulletin of January 12, 1894, issued by the North Carolina Agricultural Experiment Station, it appears that the freight on fertilizers per carload of not less than 10 tons each is $2.10 per ton of 2,000 pounds from Wilmington 84 miles to Goldsboro, and $1.60 per ton from Wilmington 83 miles to Fayetteville. The difference, 50 cents per ton, is illustrative of the effect of the river in reducing freight rates by rail.

The commercial statistics for this river have been compiled with much labor and completeness by Mr. Henry J. Clark of this office, who obtained from the steamboat company its two double royal shipping ledgers of 1,000 pages each, from which he extracted every item of produce and merchandise shipped up and down the river during the fiscal year.

The river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1893, balance unexpended	$5,986.16
June 30, 1894, amount expended during fiscal year	3,597.50
July 1, 1894, balance unexpended	2,388.66
July 1, 1894, outstanding liabilities	327.67
July 1, 1894, balance available	2,060.99
Amount (estimated) required for completion of existing project	156,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	724	Tar	1,977
Cotton seed	2	Turpentine, crude	933
Bricks	3,000	Turpentine, spirits	153
Tobacco	16	Rosin	6,349
Rice	59	Peanuts	26¼
Grains	366⅓	Lumber	56,000
Cattle	87	Shingles	465
Horses	4	Fertilizers	5,575
Hogs	14	Machinery	10
Poultry	21	General merchandise	16,953
Fish	20		
Oysters	2	Total	92,757

Increase since last year, 19,947 tons. Transportation lines established during the year, none.

List of steam vessels plying on the Cape Fear River, North Carolina, above Wilmington, for the fiscal year ending June 30, 1894.

Name.	Net tonnage.	Remarks.
D. Murchison	140.72	Regular steamers plying between Wilmington and Fayetteville, four trips per week.
A. P. Hurt	140.11	
Cape Fear	156.32	
Lisbon	66.94	Annex boat to regular steamers between Browns Reach and Fayetteville during low-water stages.
Compton	53.94	Towing between Wilmington and Navassa.
C. Killam	6.66	
Anna	....	Irregular towing for rafts, flats, etc.
F. and F	9.10	
C. F. D	4	
Wilmington	110	Irregular trips between Wilmington and Piney Bluff.

Freight transported.

Calendar year ending December 31—	Tons.
1880	50,000
1890	129,000
1891	88,698
1892	72,810

Cape Fear River, North Carolina, above Wilmington.

APPROPRIATED.

Date.	Amount.	Aggregate.
Mar. 3, 1881	$30,000	$30,000
Aug. 2, 1882	30,000	60,000
July 5, 1884	5,000	65,000
Aug. 5, 1886	11,250	76,250
Aug. 11, 1888	12,000	88,250
Sept. 19, 1890	15,000	103,250
July 13, 1892	15,000	118,250

EXPENDED.

To June 30—		To June 30—	
1882	$14,813.96	1888	$73,852.68
1883	27,801.41	1889	83,332.31
1884	42,502.54	1890	87,971.26
1885	59,013.83	1891	94,360.43
1886	64,530.81	1892	98,398.81
1887	65,832.94	1893	112,398.26

L 18.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

Pursuant to the project as modified by instructions from the Chief of Engineers of June 9, 1892, "to dredge a channel 18 feet deep at mean low water from the bar to Wilmington, and as wide as funds available in the next two years will allow," dredging has been in progress throughout the year by contract of November 3, approved November 21, 1892.

Under this contract there have been dredged during the year 537,681 cubic yards, of which 82,956¼ cubic yards were dredged from the shoal at Snows Marsh of sand, at 12.49 cents per cubic yard, and 454,724¾ cubic yards, at 12.44 cents per cubic yard, were dredged from five other shoals, mostly of mud, but containing some sand.

The dredging was at localities as follows:

Name of shoal.	Distance below Wilmington.	Length of shoal between 18-foot curves.	Dredging.
	Miles.	*Feet.*	*Cubic yards.*
Logs and Big Island	7	10,400	19,455
Keg Island	9½	2,200	16,041¼
Lilliput	11	13,100	120,869¾
Old Brunswick Cove	13½	3,800	83,571
Midnight	16	13,000	214,787¾
Snows Marsh	20	9,700	82,956¼
Total			537,681

A channel of the depth of 18 feet at mean low water was obtained through all the foregoing shoals, except that at Snows Marsh, and of widths as follow:

At Logs and Big Island Shoal, 74 feet wide for a length of 2,300 feet, and 50 feet wide for a length of 1,700 feet.

At Keg Island Shoal, 148 feet wide throughout.

At Lilliput Shoal, 148 feet wide for a length of 6,600 feet, and 111 feet wide for a length of 6,500 feet.

At Old Brunswick Cove Shoal, 270 feet wide throughout.

At Midnight Shoal, 185 feet wide for a length of 9,600 feet, 209 feet wide for a length of 2,400 feet, and 148 feet wide for a length of 1,000 feet.

At Reaves Point Shoal, 74 feet wide throughout.

But in the five and one-half months since dredging at the lower part of Lilliput Shoal ceased, the lower 2,000 feet of the channel there has shoaled to the extent of 15,622 cubic yards. The average and greatest diminution in depth by this shoaling are, respectively, 1.9 feet and 2½ feet. As shoaling had before occurred in the channel at that locality it was dredged to the depth of 19 feet, and the least mid-channel depth there June 11-13, 1894, is 16.5 feet at low water. The material so deposited in the channel is very soft mud.

The dredging at the five shoals, other than Keg Island, was in a channel which, between 1881 and 1891, had been dredged to the depth of 16 feet and width of 250 feet, except at Snows Marsh where the width was 233 feet. At Keg Island Shoal the natural depth exceeded 16 feet.

August 27 and October 13, 1893, violent southeasterly gales raised the water to a very high stage in the river, on the latter date to the highest stage of which there is any information. During these gales five of the contractor's scows went adrift, stranding in marshes from a few hundred to many hundred yards from the channel. The want of scows reduced the rate of dredging for many weeks until they were in part recovered and in part renewed.

The two dredges employed under the contract averaged during seven months, when not hampered by loss of scows, at the shoals above Snows Marsh, one 2,252 cubic yards and one 475 cubic yards daily. The dredge which at the other shoals averaged 2,252 cubic yards, at Snows Marsh Shoal averaged only 856½ cubic yards per day of twelve hours.

There have been earned under the foregoing contract during the fiscal year $66,928.88, and since the commencement, March 10, 1893, of work under it, $80,650.32.

By supplemental agreement dated March 8 and approved March 20, 1894, the contract was curtailed from a minimum of $125,000 and maximum of $140,000 to a minimum of $98,000 and maximum of $113,000, with the stipulation that unless the amount earned exceed $98,000 no further dredging shall be required under it at Snows Marsh Shoal. The curtailment was made to make available sufficient funds to build a dredging steamer for service on the bar and at Snows Marsh Shoal.

The amount remaining, June 30, 1894, to be earned to complete the contract as curtailed is $17,349.68 to the minimum, or $32,349.68 to the maximum involved.

During the year the U. S. suction dredge *Woodbury* (to December 15, 1893) dredged from Snows Marsh Shoal by forty-nine days' work 19,427½ cubic yards, and from the inner shoals of the ocean bar by sixty days' work 38,180½ cubic yards; total, 47,608 cubic yards.

The entire quantity of material dredged from the river and bar channels during the year is 585,289 cubic yards, as follows:

Above Snows Marsh by contract		454, 724¾
At Snows Marsh by contract	82, 956¼	
At Snows Marsh by *Woodbury*	19, 427½	
		102, 383¾
From the bar by *Woodbury*		28, 180½
Total		585, 289

December 16, 1893, the *Woodbury* took fire at the wharf at Southport, and her house, pilot house, and a part of her hull to the water line were consumed, when the fire was extinguished by sinking her. The damage to her hull and machinery by fire was estimated at $2,350; and with other repairs, of which she was in need, she could be restored to service at an estimated cost of $5,800.

Regarding this dredging steamer, the division engineer remarked:

> When the *Woodbury* was converted from a passenger boat into a suction dredge she was considered one of those temporary expedients that the U. S. Engineers are so often obliged to use for the want of enough money to procure the best thing for the purpose in view. Under the influence of the closing works at New Inlet the bar at the main mouth of the river commenced to deepen. To assist and hasten this effort of nature it was deemed wise to put on a machine that would loosen the sand and cause it to be more readily moved by the current which has there a considerable velocity at almost all stages of the tide. Besides hastening the deepening on the bar, the dredge was operated on a fixed range, in order to localize the deepening in a well defined and straight channel. It was expected that the main work of this dredge would be as stated above, but her hull was arranged to receive as much sand in bins as her limited capacity would permit, and the sand thus taken up to be dumped in deep water outside.
>
> It is my opinion that the most important use of the *Woodbury* was her movement back and forth in a fixed channel in which the sand was stirred up and carried off

by the tidal currents. It was not expected she would work elsewhere than on the bar. She has, however, been found useful at other points in the river, which is quite a gain. This boat has well paid for herself.

Her two sand bins hold together about 50 cubic yards, but owing to the slow rate at which the last 5 yards can be accumulated in them their available capacity is about 45 cubic yards. Her pump (an Andrews 9-inch centrifugal) with two 6-inch suction pipes filled the bins in twenty to thirty minutes.

Since July 1, 1889, the average time annually that the weather has permitted the *Woodbury* to work upon the bar is one hundred and fifteen days, and she has removed therefrom annually during that time an average of 52,820 cubic yards, being at the rate of 459 cubic yards per day when working. Of this small number of days (but little more than one-third of the number of working days annually) it appears from her record since July 1, 1893, that only 46 per cent of the time that she was actually at the bar was spent in actual dredging, the other 54 per cent being spent in going to the dumping ground, dumping, and returning.

The dredging at the bar is in two localities: First, on some inner shoals, which, December 23, 1893, were 2,900 feet in length from the 18-foot contour in the bold river channel to the 18-foot contour in a pocket 19 to 23 feet deep and 1,750 feet long, which intervenes between the inner shoals and outer bar; and, second, on the outer bar, which, December 23, 1893, was 450 feet across from the 18-foot contour in the pocket to the 18-foot contour in the ocean, and 570 feet from 20-foot to 20-foot contour.

On the outer bar the *Woodbury* has done no dredging since October, 1890, at which date the least sounding on the best mid-channel line was 19.9 feet, and for a width of 200 feet the least sounding was 18.1 feet at mean low water. June 30, 1891, this channel on the outer bar had deteriorated so that the least depth on the mid-channel line was 18.1 feet at mean low water, which depth it maintained without assistance for two years, until the summer of 1893; but the distance between 20-feet contours in the pocket and ocean increased from 300 feet in 1891 to 750 feet in 1892, continuing the same until last summer. September 6, 1893, nine days after the southeast gale of August 27 and 28, the least depth in the best line across the outer bar at mean low water was 16.5 feet, increasing in a short distance toward the sea to 18 feet, and to 19 feet toward the river. December 23, 1893, the very severe southerly to southeasterly gale of October 13 having intervened, the depth in the best line across the outer bar was 16.4 feet at mean low water, increasing quickly toward the sea to 16.9 feet, and to 17.8 feet toward the river. The distance from the 18-foot curve in the ocean to the 18-foot curve in the pocket, which was 450 feet December 23, 1893, was only 150 feet September 6, 1893.

On the inner shoals the Annual Report of 1890 stated that the available depth did not exceed 17 feet. In the next fiscal year the *Woodbury* dredged from these shoals 54,716 cubic yards to June 30, 1891, when the available depth was again reported not to exceed 17 feet. In the next year the *Woodbury* dredged from the same locality 46,599 cubic yards to June 30, 1892, and the depth continued 17 feet as before. The average annual quantity, 50,657 cubic yards (measured in bins), dredged from these shoals in the two years from June 30, 1890, to June 30, 1892, seems to have been about the rate of shoaling in one year.

A survey of the shoals May 12 to 25, 1893, showed a channel depth on their crests of only 15.2 feet, and a comparison of the two surveys of May and December, 1893, showed 18,667 cubic yards of shoaling in a channel width of 300 feet between those dates. Being engaged from June to December, 1892, at Snows Marsh in the river, the *Woodbury* had dredged from the shoals between the two surveys only 23,376 cubic yards. Increasing the 18,667 cubic yards (in situ) one-fourth for bin measurement, and adding the amount dredged, would give 46,710 cubic yards of shoaling between April, 1892, and May, 1893. The amount, about 50,000 cubic yards per year, dredged in maintaining the depth of 17 feet on the inner shoals from June, 1890, to June, 1892, seems, therefore, to be about the amount of shoaling to be contended against annually in maintaining 17 feet on these shoals.

The amount of shoaling on the outer bar in a channel width of 300 feet, between May and December, 1893, was 7,333 cubic yards in place.

The *Woodbury's* dredging has been restricted to a channel width of 200 feet, mainly along its middle line.

The quantity of sand in situ to be removed to obtain a channel 300 feet wide and 18 feet deep from the river to the ocean was, December 23, 1893, estimated on the inner shoals at 92,533 cubic yards, and on the outer crest at 11,334 cubic yards, a total of, say, 104,000 cubic yards, or, allowing one quarter increase, 130,000 cubic yards bin measurement, which is about 2½ times the quantity the *Woodbury* is able to remove in a year. This quantity embraces an allowance, outside of the 300 feet, for side slopes of 1 on 60, that being the approximate slope between the 12 and 18 foot curves along the side of the channel immediately within the shoals.

Even were the rate of shoaling that has to be contended against to be no greater in maintaining 18 feet than in maintaining 17 feet, to obtain a depth of 18 feet for a width of 300 feet in one year would entail the removal from the inner shoals and bar of 180,000 cubic yards (bin measurement) or to obtain the same in two years would require the removal yearly of 115,000 cubic yards, the former being 3.3 times and the latter about 2¼ times the *Woodbury's* capacity in the exposed location of the bar.

Seven miles above the bar at Snows Marsh Shoal, near the former junction of New Inlet, where the river spreads to its greatest width of 2¼ miles, much difficulty has been encountered in maintaining a depth of 16 feet ever since December, 1883, when the channel was completed to that depth from Wilmington to the bar. A part of the channel there in fine sand shoals so rapidly, quite extensive redredging annually is necessary to permit egress of steamers drawing 17 to 18 feet during the shipment of cotton in the fall and winter months. A dredging steamer employed in maintaining the channel on the bar would, when the sea is too rough to permit her to work there, lie at Southport, only 2 miles below Snows Marsh Shoal, and could at such times be employed with great advantage in the channel at that shoal, and at an additional cost for fuel only.

For obtaining and maintaining a channel to the depth of 18 feet on the bar and also at Snows Marsh in conjunction with training works of a tentative and inexpensive character to be built at the latter locality, it was, January 18, 1894, recommended that instead of repairing the *Woodbury* a dredging steamer of much greater pumping and bin capacity be obtained.

Upon that recommendation the Division Engineer remarked:

> The *Woodbury* having been now so much injured by fire and the need for continued work on the bar to retain the best depth having been shown, although a marked increase was obtained and may be expected to remain without any work

there, the question arises, What is the best course to pursue under the existing circumstances?

Some have thought of having recourse to jetties at the mouth of the river. Several reasons cause me to refrain from recommending them at this time. They are expensive to build, take a long time for completion, judging from past experiences, and are not certain as to results.

A suction dredge is much cheaper, more speedy in producing results, and experience has shown that it is a sufficient means for bringing about what is needed in this case.

It is recommended that Maj. Stanton's propositions be approved, and that the new machine be obtained at as early a day as possible, equipped in the best manner allowable with the funds available. The new dredge should be a great improvement on the *Woodbury* in the light of the experience on the Cape Fear and elsewhere in the years since she was built.

After some delay in effecting a supplemental agreement so modifying the contract of November 3, 1892, for dredging as to make the necessary funds available, and, after an ineffectual search for a vessel that could be purchased and converted to the purpose, March 28, 1894, the Chief of Engineers authorized the necessary measures to be taken preparatory to building a dredging steamer. The design and specifications have been prepared in this office by Mr. John H. Dahl, a naval architect of Boston, Mass., and proposals for building the vessel, with propelling and dredging machinery complete, will be opened August 2, 1894. Her length over all is to be 131 feet 3 inches; breadth of beam, 29 feet; draft, light, approximately 10 feet; draft, loaded with 180 cubic yards of sand, about 12½ feet, and she is to be equipped with two 10-inch centrifugal pumps.

In October, November, and December many current observations were taken for a distance of about 4 miles in the channels at Snows Marsh Shoal, guided by which a project was submitted January 3 for a training work of piles, brush, and stone to be built tentatively in connection with dredging. This project was approved January 10, but by authority from the Chief of Engineers its execution was postponed until the training work could be built in conjunction with dredging by the new dredging steamer, and to insure sufficient funds for building the latter.

During the year a survey of the bar and shore lines at the river mouth was completed and extended from the ocean up 11 miles to a point about 2 miles above Snows Marsh Shoal, embracing the river's full width, about 19 square miles of hydrography and 20 miles of beach line. All those parts of the channel where the depth is less than 20 feet at mean low water between Snows Marsh and Wilmington have also been surveyed for a width of 300 feet. The aggregate length of river and river channel surveyed is 28½ miles, besides three resurveys of the bar and Snows Marsh channels and one of Brunswick Cove Channel.

The gauges on the river from Wilmington to Baldhead Point at the mouth were also connected by a line of levels run by Mr. S. F. Burbank.

From these surveys it appears by the appended estimate of Mr. Charles Humphreys, assistant engineer, that the quantity of material remaining, June 30, 1894, to be removed to obtain a channel 18 feet deep at mean low water and 270 feet wide from Wilmington to Southport, or to the bar, is 695,785 cubic yards, or, to obtain a channel 20 feet deep at mean low water and 270 feet wide, 2,070,417 cubic yards. The foregoing quantities are estimated to the above exact depths, and contain no allowance for the inflow of material from the sides, which latter may much increase the quantity at the shoals above Snows Marsh where the bottom is soft mud, and especially at Snows Marsh Shoal, upon whose crest on the line of the present channel the depth was only 3 feet when the dredging commenced, and where the channel, on the one or on the other side, is for about 3,000 feet bordered by shoals of considerable height, consisting of fine sand.

Work under the project to obtain a channel 20 feet deep, at mean low water, from Wilmington to the ocean ceased on the completion, September 7, 1892, of the contract of December 24, 1890, for dredging to that depth, pursuant to instructions from the Chief of Engineers of June 9, 1892, "that a channel 18 feet deep, and as wide as funds will allow, be dredged from the bar to Wilmington in order that the navigation be improved to that extent as soon as possible, it being left to the experience of the next few years to decide whether it be necessary or expedient to work for a greater depth."

A channel to the depth of 20 feet and width of 270 feet, having been completed through the shoal, 3,200 feet in length, at Wilmington in 1891, the remaining aggregate length of dredging done and to be done through the nine shoals between Wilmington and Southport, to obtain a channel 18 feet deep at mean low water, is 14.3 miles, and to be done to obtain a channel 20 feet deep at mean low water is 17.6 miles.

June 30, 1894, the depth of the channel at mean low water is as follows: From Wilmington, 20 miles to Snows Marsh Shoal, 18 feet, except where the shoaling has occurred at the lower extremity of Lilliput Shoal, where the depth is 16½ feet, and the bottom of very soft sludge; at Snows Marsh Shoal, 14 feet; on the inner shoals at the bar, 16 feet by a crooked channel and 14.3 feet by a straight course, and on the outer bar, 16.6 feet.

The mean range of the tide is 4½ feet at the bar and as far up as Snows Marsh Shoal, and 2½ feet at Wilmington.

The dredging and surveys since October, 1893, have been under the immediate charge of Mr. Charles Humphreys, assistant engineer, assisted by Mr. Robert Merritt.

The following extract is from the published report of the president of the Wilmington Produce Exchange:

> To the 31st of March, 1894, we have received 186,730 bales of cotton, against 155,950 bales for the same time last year, showing a gain of about 20 per cent, which will compare favorably with the other ports.
>
> Our receipts of naval stores have been: Spirits turpentine, 45,690 casks, against 57,536 last year: rosin, 216,477 barrels, against 261,894 barrels last year; tar, 45,139 barrels, against 67,142 barrels last year; crude turpentine, 9,963 barrels, against 14,855 barrels last year.
>
> The exports of lumber have been 30,595,930 feet, against 29,026,414 feet last year.

A description of and résumé of former operations upon this river may be found on pp. 1164–1169 and pp. 1419–1423 of the Annual Reports of the Chief of Engineers, respectively, for 1892 and 1893.

Wilmington is a port of entry.

Money statement.

July 1, 1893, balance unexpended		$178,054.59
June 30, 1894, amount expended during fiscal year		76,516.25
July 1, 1894, balance unexpended		101,538.34
July 1, 1894, outstanding liabilities	$21,773.12	
July 1, 1894, amount covered by uncompleted contracts	32,349.68	
		54,122.80
July 1, 1894, balance available		47,415.54

Amount (estimated) required for completion of existing project, if to 18 feet	$400,000.00
Amount (estimated) required for completion of existing project, if to 20 feet	1,430,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	250,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3 1893.

ESTIMATE OF MR. CHARLES HUMPHREYS, ASSISTANT ENGINEER.

WILMINGTON, N. C., *June 30, 1894.*

ESTIMATE.

Estimate of amount of dredging and length of cutting to dig a channel 18 feet and 20 feet deep and 270 feet wide from Wilmington to Southport after June 30, 1894.

Name of shoal.	To 18 feet.		To 20 feet.	
	Dredging.	Length.	Dredging.	Length.
	Cu. yds.	*Feet.*	*Cu. yds.*	*Feet.*
Alligator Creek	40,280	10,750	109,000	11,150
Brunswick River	29,073	8,600	135,333	8,750
Between Brunswick River and Logs and Big Island	19,548	1,800	85,680	5,700
Logs and Big Island	36,834	10,400	230,822	10,900
Keg Island	14,505	2,200	81,700	4,000
Lilliput	146,970	13,100	391,395	17,200
Old Brunswick Cove	....	....	68,400	5,000
Midnight	92,287	13,000	376,287	14,500
Reaves Point	13,288	2,000	78,800	4,400
Snows Marsh	303,000	9,700	513,000	11,100
Total	695,785	75,350	2,070,417	92,700

The above amounts are for place measurement and no allowance is made for side slopes. There may be 50 stumps at Brunswick River Shoal, 50 between there and Logs and Big Island, and 100 at Logs and Big Island Shoal.

In case the side slopes should become the same as those in the vicinity of the different shoals, where the bank is believed to be stable, additional dredging will be required, as follows:

Name of shoal.	Slope.	18-foot channel.	20-foot channel.
		Cu. yds.	*Cu. yds.*
Alligator Creek	1 on 4	3,700	10,000
Brunswick River	1 on 4	943	2,175
Between Brunswick River and Logs and Big Island	1 on 4	4,200	8,000
Logs and Big Island	1 on 4	914	14,667
Keg Island	1 on 10	2,750	16,667
Lilliput	1 on 20	207,000	436,500
Old Brunswick Cove	1 on 20	....	35,625
Midnight	1 on 40	390,000	965,067
Reaves Point	1 on 30	23,500	74,700
Snows Marsh	1 on 60	940,000	1,760,000
Total for side slopes	....	1,573,007	3,323,401
Add for channels as above	....	695,785	2,070,417
Total for channels and side slopes	....	2,268,792	5,393,818

Respectfully submitted.

CHAS. HUMPHREYS,
Assistant Engineer.

Maj. W. S. STANTON,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Commerce, foreign and domestic, for the year ending December 31, 1893.

[Itemized statistics furnished by Col. J. L. Cantwell, secretary of Wilmington Produce Exchange.]

Class of goods.	Tonnage.	Class of goods.	Tonnage.
EXPORTS.		EXPORTS—continued.	
Cotton	48,545	Peanuts	691
Cotton goods	510	Miscellaneous, estimated	75,000
Yarns	110		
Paper stock	38	Total	242,965
Turpentine, spirits	11,217		
Turpentine, crude	887	IMPORTS.	
Rosin	33,612		
Tar	7,460	Miscellaneous, estimated	150,000
Pitch	436		
Lumber	61,192	Total	392,965
Shingles	3,267		

Gain over last year, 48,222 tons. Transportation lines established during the year, none.

Foreign commerce for 1893.

[Furnished by Mr. Cronley, deputy collector of customs.]

Class of goods.		Quantity.	Value.	
			Exports.	Imports.
Cotton	bales	167,712	$6,766,730	
Rosin	barrels	202,849	250,872	
Tar	do	7,376	11,372	
Pitch	do	360	1,324	
Spirits turpentine	gallons	816,501	219,797	
Lumber	M feet	15,156	202,300	
Shingles	per M	2,186	9,545	
Miscellaneous			4,926	$119,187.13
Total			7,466,872	119,187.13

Statement of vessels of 100 tons and over at the port of Wilmington, N. C., for the year ending December 31, 1893.

[Furnished by Capt. Joseph Price, harbor master.]

	Vessels.	Tons.
American	185	84,663
Foreign	94	61,548
Total	279	146,211

Cotton steamers loaded at the port of Wilmington, N. C., during the year ending December 31, 1893.

[Furnished by Messrs. Alex. Sprunt & Son.]

Name.	Tonnage.	Draft loaded.		Number of bales.	Remarks.
		Ft.	*In.*		
Ramleh	1,667	17	11	8,825	Loaded by A. Sprunt & Son.
Leander	1,888	17	10	10,082	Do.
Schiehallion *	1,041	17	8	4,275	Do.
Daylight	1,534	17	8	7,889	Do.
Venus	1,908	17	7	9,800	Do.
Ormesby	1,828	17	7	10,044	Do.
Gloucester City	1,409	17	2	7,629	Do.
Tripoli	1,686			8,664	Loaded by Heath Cotton Co.
Capulet	1,461			6,400	Loaded by J. H. Sloan.
Swainby	1,763	17	6	8,900	Loaded by A. Sprunt & Son.
Greatham	1,531	17	4	7,652	Do.
Tormore	1,021	15	6	5,050	Do.
Petunia	1,093	17		5,818	Do.
Maltby	1,804	16	3	9,523	Do.
Castle Ventry	1,915	17	10	10,000	Do.
Clyde	992	16	8	4,592	Do.
Guy Colin	1,463	16	10	7,217	Do.
City of Worcester	1,553	16	6	7,150	Do.
Huntcliff	2,018	17	5	10,000	Do.
Wandsworth	1,119			5,375	Loaded by J. H. Sloan.
Sandhill	1,335			6,079	Do.
Craigmore	1,458			6,664	Do.
Total				167,628	

* The Schiehallion reached Wilmington with a part cargo of 793 tons of copper ore.

Freight transported.

Calendar year ending December 31—	Tons.
1869	220,000
1889	325,512
1890	346,557
1891	344,743
1892	341,468

Cape Fear River below Wilmington.

APPROPRIATED.

Date.	Amount.	Aggregate.
Mar. 2, 1829, to July 22, 1854		*$363,228.92
July 11, 1870	$100,000	100,000.00
Mar. 3, 1871	75,000	175,000.00
June 10, 1872	100,000	275,000.00
Mar. 3, 1873	100,000	375,000.00
June 23, 1874	150,000	525,000.00
Mar. 3, 1875	150,000	675,000.00
Aug. 14, 1876	132,500	807,500.00
June 18, 1878	160,000	967,500.00
Mar. 3, 1879	100,000	1,067,500.00
June 14, 1880	70,000	1,137,500.00
Mar. 3, 1881	140,000	1,277,500.00
Aug. 2, 1882	225,000	1,502,500.00
July 5, 1884	200,000	1,702,500.00
Aug. 5, 1886	157,500	1,860,000.00
Aug. 11, 1888	245,000	2,105,000.00
Sept. 19, 1890	170,000	2,275,000.00
July 13, 1892	200,000	2,475,000.00

* Balance of $3,723.07 turned over to surplus fund.

EXPENDED.

To June 30—		To June 30—	
1829 to 1858	$359,500.85	1882	$1,214,469.26
1871	102,514.18	1883	1,334,107.48
1872	177,950.67	1884	1,473,102.90
1873	284,663.32	1885	1,632,358.93
1874	377,048.45	1886	1,697,691.74
1875	463,712.57	1887	1,773,946.25
1876	652,277.28	1888	1,851,036.14
1877	719,567.75	1889	1,903,924.47
1878	806,941.76	1890	2,093,885.87
1879	938,408.82	1891	2,159,534.61
1880	1,042,390.55	1892	2,258,599.29
1881	1,131,949.68	1893	2,665,171.33

L 19.

IMPROVEMENT OF LOCKWOODS FOLLY RIVER, NORTH CAROLINA.

A description of this river, the nature and extent of its commerce, the project for its improvement, and the work accomplished thereunder, are fully given on pp. 1177–1181 and pp. 1432–1434 of the Annual Reports of the Chief of Engineers for 1892 and 1893, respectively.

The amount ($3,000) appropriated July 13, 1892, being too small to enable a contract for dredging to be made at an advantageous price, the Secretary of War, August 4, 1892, authorized it to be withheld from expenditure for the present, and no work has been done during the fiscal year ending June 30, 1894.

The river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1893, balance unexpended	$3,024.86
June 30, 1894, amount expended during fiscal year	24.86
July 1, 1894, balance unexpended	3,000,00
Amount (estimated) required for completion of existing project	32,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	*22,000,00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commerce for the year ending December 31, 1893, is estimated as follows:

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	9	Turpentine, crude and spirits of, and rosin.	340
Tobacco	1		
Rice	16	Lumber and its products	850
Grains	55	Fertilizers	20
Vegetables	56	Machinery	8
Live stock, including poultry	2	General merchandise	250
Meats and their products	18		
Fish and shellfish	230	Total	2,055
Tar	200		

Decrease since last year, 306½ tons. Transportation lines established during the year, none.

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* No further money can be profitably spent upon this improvement, but if it is to be continued, $22,000 is the amount that can be most advantageously applied.

Freight transported.

Calendar year ending December 31—	Tons.
1890	7,000
1891	2,833
1892	2,361½

Lockwoods Folly River.

APPROPRIATED.

Date.	Amount.	Aggregate.
Sept. 19, 1890	$5,000	$5,000
July 13, 1892	3,000	8,000

EXPENDED.

To June 30:	
1891	$19.81
1892	4,964.32
1893	4,975.14

L 20.

IMPROVEMENT OF GEORGETOWN HARBOR, SOUTH CAROLINA.

The project adopted in 1881 to dredge a channel 12 feet deep at ordinary low water, 200 feet wide and about 2,850 feet long through a shoal in Winyaw Bay, at the mouth of Sampit River and entrance to Georgetown Harbor, which is that part of the river immediately above its mouth, at a cost estimated in 1889 at $44,500, was completed January 10, 1893, at a total cost of $42,146.31, at which date there was a channel 200 feet wide and 12 feet deep entirely through the shoal at the entrance to the harbor.

During the fiscal year ending June 30, 1894, in maintenance of this channel, work has embraced only the removal of 32 logs and 4 stumps, and the erection of 4 beacons to guide vessels clear of its banks.

Georgetown is a port of entry.

Money statement.

July 1, 1893, balance unexpended	$2,271.69
June 30, 1894, amount expended during fiscal year	644.11
July 1, 1894, balance unexpended	1,627.58
July 1, 1894, outstanding liabilities	2.60
July 1, 1894, balance available	1,624.98

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons
Cotton	2,000	Lumber	103,000
Wool	5	Shingles	10,000
Rice	5,400	General merchandise	105,000
Vegetables, including truck	350		
Poultry and eggs	10	Total	268,640
Fish and shell fish	4,175		
Turpentine, crude and spirits of, and rosin	38,700		

Ten thousand passengers were carried during the year.

List of vessels plying between Georgetown, S. C., and other ports during the calendar year ending December 31, 1893.

Name.	Net tonnage.	Name.	Net tonnage
STEAMERS.		SAILING VESSELS—continued.	
Croatan	827		
Pawnee	858	Edgar C. Ross	378.71
Benefactor	637	W. T. Parker	169.80
Fanita	289	E. R. Hill	68.25
Alexander Jones	69.37	Cornelia	57.13
W. S. Brusstar	....	Thos. J. May	213 41
Planter	499.16	Annie E. Stephens	227 62
John M. Cole	318.41	Hattie L. Sheets	175.41
Maggie	279.26	Red Wing	415.26
Driver	111.08	J. H. Cannon	220.47
Ruth	39.85	Percy W. Scholl	227.71
Two Brothers	97.37	Nellie Floyd	434.73
Maggie, No 2	72.63	Annie V. Lamson	320.92
Janey	17.21	Caroline Hall	237.89
Emma	19.86	Alfaretta S. Snare	240.83
Merchant	405.55	Abbie H. Gheen	253.31
S. S. Brewstar	59.61	Nimrod	279.66
Emma A. Twiggs	16.79	A. B. Crosby	159
William C. Turner	28.86	B. I. Hazard	372.96
Fearless	18.92	E. H. Smith	380
Henry Lloyd	13.01	Lucie Wheatly	180.39
Maria C	8	Chas. Chister	206.75
		Minnie Bergen	308.50
SAILING VESSELS.		Amelia P. Schmidt	265.96
		Ida C. Schoolcraft	304.19
Adele Ball	401.22	E. C. Knight	224.93
R. A. Snyder	357.14	Florence and Lillian	238.52
C. C. Lister	266.75	Chas. H. Trickey	206.96
Waccamaw	435.60	Wm. T. Parker	169.80
L. C. Kaminski	421.38	Encore	16.65
Edna and Emma	173.64	Prosperity	15.41
J. C. Gregory	360.29	Longfellow	7
Percy and Lillie	478.61	Annie Wahab	32.46
Warren B. Potter	349.92	Etta	8
Ettie H. Lister	312.35	Chief	18.69
Myra W. Spear	148.25	Winyaw	18.69

Freight transported.

Calendar year ending December 31—	Tons.
1882	120,880
1888	157,531
1889	196,734
1890	241,648
1891	245,982
1892	271,906

Georgetown Harbor, South Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
July 4, 1836	*$1,000	....
Aug. 30, 1852	†3,000	$3,000
Aug. 2, 1882	7,000	7,000
July 5, 1884	5,000	12,000
Aug. 5, 1886	5,000	17,000
Aug. 11, 1888	7,500	24,500
Sept. 19, 1890	8,000	32,500
July 13, 1892	12,000	44,500

*Not used; turned over to surplus fund. † Balance of $0.03; turned over to surplus fund.

EXPENDED.

To June 30—		To June 30—	
1853 to 1854	$2,999.97	1889	$23,842.63
1885	8,433.85	1890	23,877.57
1886	11,986.04	1891	23,935.73
1887	16,622.50	1892	32,141.12
1888	16,834.10	1893	42,228.31

L 21.

IMPROVEMENT OF WINYAW BAY, SOUTH CAROLINA.

A description of this bay and summary of the operations for the improvement of the bar at its entrance will be found on pp. 1187–1191 and pp. 1441–1448 of the Annual Reports of the Chief of Engineers for 1892 and 1893.

The project of 1885, approved by the Board of Engineer Officers in 1888 and by the Chief of Engineers in 1889, is to increase the depth of water to about 15 feet at mean low water in Bottle Channel by building to the height of 6 feet above mean low water to the 18-foot curve a north jetty 10,700 feet long from North Island and a south jetty 17,500 feet long from South Island, across the main channel, the jetties converging to 4,000 feet at the 18-foot curve, at a total estimated cost for the 28,000 feet of jetties of $2,500,000.

The placing of mattresses and stone in the north jetty, which was in progress at the commencement of the fiscal year by contract of November 8, 1892, with Charles G. Bochman, of Charleston, S. C., was suspended upon the completion of that contract July 22, 1893, since which date, no funds being available, no work has been done on the jetty.

There were placed in the jetty during the fiscal year 1,255.89 square yards of mattresses and 2,089.34 tons of small stone, and in the aggregate under Mr. Bochman's contract from the commencement of work under it, January 27, 1893, until its completion, July 22, 1893, 14,562.27 square yards of mattresses, 579.13 tons of large stone, and 19,111.20 tons of small stone.

Under Mr. Bochman's contract the mattresses were advanced 1,279 feet, and the jetty was advanced that distance with a height gradually increasing from the thickness of the ballast on the mattresses, 2 feet, up to a few inches above low water. The part above low water was, besides, advanced 185 feet, and 553½ linear feet of trestle were built.

The jetty now extends, with a height of 18 inches above low water, 2,200 feet from the original shore line, and the mattresses 1,464 feet farther, in which latter distance the height of the jetty gradually diminishes to the thickness of the ballast on the mattresses. The entire distance from the extremity of the jetty on shore to the extremity of the mattresses is 4,254 feet.

The plan and longitudinal profile of the jetty as it was June 30, 1893, are shown on the sheet facing page 1448 of the Annual Report of the Chief of Engineers for 1893, after which date the mattresses were advanced only 127 feet.

The aggregate quantity of materials placed in the jetty under all the contracts is as follows: Mattresses, 39,057.74 square yards; stone, 77,684.29 tons; sheet piling, 194,976 feet B. M.; and oyster shells, 601 cubic yards.

The violent gales of August 27 and October 13, 1893, carried away the stringers, caps, and cross ties of about 1,500 linear feet of the trestle; also the wharf and storehouse belonging to the Government at North Island.

To prevent hurtful changes to the tidal regimen of the bay that would be caused by the overflow along about 2 miles of shore line of an extensive marsh at the southerly side of its entrance, and whose surface is about 1 foot below mean high water, the construction of a dike of earth about 11,000 feet in length was authorized by the Chief of Engineers May 10, 1892.

The Rittenhouse Moore Dredging Company, of Mobile, Ala., with whom contract was entered into December 21, 1892, for building the dike, did not reach the bay with their plant until June 2, 1893, which was without appliances suited to the work. July 27, 1893, the date prescribed in the contract for the completion of the dike, the contractors had not commenced to build it, although repeatedly cautioned of the disadvantage delay would entail from the increasing overflow and saturation of the site by the sea, owing to the gradual destruction of the sand beach, whose crest had been high enough to prevent overflow.

By authority from the Chief of Engineers of August 12, 1893, the contract with the Rittenhouse Moore Dredging Company was annulled, and contract was entered into August 23, 1893, with the next lowest bidder, Mr. Charles G. Boehman, of Charleston, S. C., at 27 cents per cubic yard.

After constructing an entire plant adapted to the work, the contractor arrived at the bay with it November 9, after some delay unavoidable in consequence of the gales of August and October. November 27, when the plant had cut its way through the marsh to the site of the dike, it was found that the site was so saturated by the sea, owing to the destruction of hundreds of feet of the protecting beach in the eleven months since the contract was entered into with the Rittenhouse Moore Dredging Company, and especially by the gales of August and October, that it was impracticable to build the dike at the site specified in the contract, the material flowing so freely as to close in upon and threaten the imprisonment of the dredge which delivers the material on the berm to the conveyor which transfers it and deposits it in the dike.

After obtaining the necessary right of way, an agreement supplemental to the contract was entered into January 2, and approved January 15, 1894, for building the dike along a causeway lying at its northerly end about 1,500 feet and at its southerly end about 5,000 feet from the sea. About 500 acres of the marsh have been surrendered to the sea by this change of site.

The building of the dike commenced at its northerly end, resting on the firm land north of the marsh, and to June 30 it has been built to full dimensions for a length of 1,800 feet and to about two-thirds of the cross section for a farther distance of 1,150 feet.

The dike, if it follow the causeway its entire length from the firm land north to the firm land south of the marsh, will be 12,300 feet long, but if it be found practicable to build the southerly 4,720 feet of the dike upon the marsh where it is somewhat firmer and where the causeway diverges in direction farther from the sea, its length may be restricted to about 10,500 feet.

The dike has a cross section of 324¾ square feet, and each lineal foot contains 12 cubic yards, costing at the contract price 27c. per cubic yard, $3.24.

The dike is on the seaward side and the borrow ditch on the landward side of the causeway which forms the berm.

The mud dredged from the marsh is dumped from the dredge bucket through a hopper into cars which are pulled by a hoisting engine up an inclined trussed frame projecting over the dike about as far as its exterior (seaward) crest, near which line the mud is dumped from the cars through their movable bottoms.

The material thus deposited along the line of the seaward crest in accumulating to the height of about 6½ feet flows so as to spread to the full width of the base of the dike forming the lower two-thirds of the area of its cross section, but if the dumping be continued after the height of 6 to 7½ or 8 feet be reached, depending upon the variable consistency of the material, the latter would flow beyond the toe of the seaward and landward slopes of the dike, adding little to its height.

The conveyor, consisting of a platform from which projects the inclined trussed frame and which also supports the hoisting engine and the hoppers under which stand the cars when receiving the material from the dredge bucket, rests on trucks rolling on two narrow iron tramways placed on the berm, one near the landward slope of the dike and the other near the crest of the ditch excavated in obtaining the material. As the dike reaches the height of 6 to 8 feet the conveyor and dredge move abreast along it, leaving the upper third of its volume to be added when the material in the lower two-thirds has become sufficiently dry and firm to sustain it. It is thus necessary for the contractor to construct a very considerable length of the dike to about two-thirds cross section before the lower part becomes firm enough to receive the upper third of the volume, when the dredge and conveyor again pass along it, entailing, however, upon the contractor considerable extra work in the relaying of the tramway along the berm.

As the contract prescribed that the contractor should be paid at the close of each month only for such a part of the dike as he completes to full cross section during that month, a supplemental agreement was entered into with him May 2, and approved May 9, 1894, permitting payment to be made the contractor at the close of each month for not to exceed one-half of the material placed within the bounding lines and surfaces of so much of the dike as he builds to partial cross section during that month.

Attention is respectfully invited to the following extracts from letters from enterprising and responsible business men most familiar with the requirements of the commerce of the bay and with the resources of the region traversed by the six rivers tributary to it:

[From H. Kaminski & Co., wholesale merchants of Georgetown, June 16, 1893.]

It is a well-known fact that the development of the vast section of country to the rear of, and tributary to, Winyaw Bay by its vast river connection is just now in its infancy; that with the advantages we now enjoy of a first-class steamship line, several lines of schooners, and railroad connection, we are all the more made to feel our almost utter helplessness, from that fact, that we have the cargoes of lumber, cross-ties, naval stores, rice, shingles, cotton, etc., to ship; that we have tonnage to convey all this valuable cargo to its destination provided we could transport it across our ever-menacing sea bar. The result is that our steamships, in order to recross the bar with any degree of safety, have to load very lightly, taking not half a cargo, frequently leaving more cargo here (as was the case this week) than the ship carried. This of course necessitates the ships making another port (Wilmington) in order to complete cargo. Now, it is reasonable to suppose that this cargo would accumulate from week to week so that something has to be done with it, hence it is shipped by steamer from here to Charleston, there transferred to ships of the Clyde line, and then past our doors to go to its destination. It is needless to say that did the depth of water on Winyaw Bay Bar admit the ships of this line taking full cargoes, which they could get direct from here to New York, that the rate of freight would be very much less than it is now when their entire cargoes are compelled to make two ports, one part via Wilmington, the other via Charleston, in order to reach destination. It is further unnecessary to call your attention to the fact of the extra hazard shipping now takes in crossing and recrossing this bar to what it would be were the bar so conditioned as to accommodate the vast traffic awaiting its improvement, and which traffic is, in our opinion, steadily increasing, and will continue to still more rapidly increase with the increased assurance from the General Government that a vast territory will not be allowed to languish for the sake of a sufficient appropriation with which to more rapidly complete what has now become to be a pressing need.

Our many years' experience in the management of sail vessels has taught us the indisputable knowledge that weeks of detention, which frequently occur at this bar in consequence of an insufficiency of water on the bar after vessels have completed cargo, makes it very difficult to charter vessels when needed, even at the increased rate of freight made obligatory in consequence of preference being given to deep-water ports over ours. You can readily understand why this should be so and why it is that many times even when we are willing to pay advanced rates over competing ports on either side of us they are given the preference, while the doors of our commerce are completely blocked. While this condition of affairs entails a hardship on shipping and shippers, the greatest burden is borne by the thousands of laborers and producers inhabiting the vast section of country whose waterways find outlet to the sea at this point. Every one of these subjects of the Government are to a greater or less degree injuriously affected by their unfortunate environment.

[From Charles Marthinson, lumber merchant, of Georgetown.]

The inadequate means for shipping lumber and other forest products from here by water, because of the obstruction of the bar and the entrance to this port and the seeming slow progress of deepening the channel affects the lumbering interests here most seriously, and has been the means of preventing many sawmills from being built and from having a prosperous and very extensive lumbering business here at this time.

My personal knowledge of the timber resources tributary to this place, which I have nearly all obtained from my own explorations, enables me to place before you the following facts:

There are in the aggregate nearly 2,000 miles of navigable and floatable streams tributary to and on which timber can be rafted to Georgetown.

The lands on each side of these streams will average nearly a mile in width for about 800 miles, and compose what is termed alluvial or swamp land and is covered with an immense forest of cypress, pine, oak, gum, ash, and many other varieties so common to this class of soil; or in other words there are in the aggregate about 1,000,000 acres of this kind of forest with no other outlet except for floatage by stream to this place. My conservative estimates of timber on these lands is over 8,000,000,000 feet board measure. In this I have not included any supply of timber from the vast quantities of long and short leafed pine growing beyond the limits on either side of these swamps and within easy reach of the streams in question and of still much greater quantity.

In any event I am prepared to offer you conclusive evidence based upon my own observation that there is sufficient cypress timber alone on this land to keep ten large sawmills in full operation for a period of twenty years.

The unfortunate state of affairs in not having the obstructions removed so as to allow larger vessels and ample shipping facilities merits your most serious consideration, and, in my best judgment, I deem it of the utmost importance that the next appropriation by Congress for the deepening and improving of this harbor should not be less than $800,000.

[From H. H. Gardner, president of the Gardner & Lacy Lumber Company, of Georgetown, S. C.]

Some three years ago our attention was called to the timber resources of this part of the State of South Carolina and the southeastern part of North Carolina, and from our investigations became satisfied that the supply of timber was practically inexhaustible.

We were attracted to this particular location as a desirable point for the establishment of a lumber and shingle manufacturing plant on account of its central location to which timber could be floated so cheaply and easily from the various rivers that flow into Winyaw Bay and from the Santee through Mosquito Creek. We were encouraged to think that the Government improvement at the entrance to the harbor would soon give deep water, and consequently better and cheaper shipping facilities.

About two years ago we invested largely in timbered swamp land and have built and equipped a complete modern mill with a daily capacity of 50,000 feet of lumber and 40,000 shingles, which with other improvements brings our investment and capital employed in our business to over $100,000.

But we find ourselves still at a great disadvantage on account of lack of water over the bar, so that in making shipments we are confined to small vessels, which are often hard to obtain, while shippers from neighboring ports have no difficulty in obtaining vessels and at a lower rate of freight. We are thus compelled to pay 50 cents to $1 per 1,000 more freight than is asked from Charleston and more southern ports to our northern markets.

This discrimination against Georgetown we believe would be entirely removed if the work of deepening the entrance channel could be pushed to completion. With this work completed we believe others would be attracted to this locality, as we have been, for the establishment of manufacturing establishments, for there is no place on the coast where can be had so great a supply of timber and in so great variety.

We write you for the purpose of adding whatever influence our voice may have in urging that a sufficient appropriation may be asked for to prosecute this work more rapidly. We are informed that the present appropriation will soon be exhausted and that work will cease and that twelve months or more will elapse before any further appropriation that may be made by Congress will be available. We believe that $750,000 should be had to prosecute this work with vigor, which when completed will benefit not only various manufacturing interests such as ours, but directly and indirectly the population of a large part of the State who people the territory drained by the various rivers centering here and which flow through nearly every county in the State.

Mr. W. D. Morgan, the mayor of Georgetown, at the head of the bay, in inclosing a detailed statement of its commerce for the year 1893, remarks:

Compared with the commerce of 1892 it shows on its face a shrinkage of over $1,000,000. This falling off is due to lower prices, restricted business caused by last year's financial panic, and the destruction of over 80 per cent of the rice and other crops raised in this section by the fearful and destructive gales of last August and October. Notwithstanding these serious losses and other causes affecting the business of the port, the gross tonnage of Winyaw Bay for 1893, I am confident, will approximate closely that of 1892, because of the large increase in the lumber and shingle business, necessitating more carrying vessels. The lumber, shingle, and cross-tie business is increasing yearly, and promises in the near future to contribute in a large and marked degree to the volume of trade of this port. Northern and Western capitalists are being attracted to this place and its tributary rivers because of the almost inexhaustible supply of the finest quality of cypress and pine timber, not to speak of various other woods that line the banks of the thousand miles of navigable rivers that are tributary to Winyaw Bay. Large amounts of foreign capital have already been invested in lumbering plants in this section, and we have every assurance that two or three sawmills will be erected in Georgetown, or near Georgetown, within the next twelve months, which will increase the commerce of Winyaw Bay materially.

The disadvantage our business men labor under at present is as to rates of freight as compared with other ports to the southward of this; the shallow condition of the bar admitting vessels drawing only 11 or 11½ feet of water and charging higher rates of freight.

At least until the north jetty is much further advanced, commerce can derive no appreciable benefit from the money applied to the improvement, and it is needless to cite the fact that under large contracts the money will accomplish more, besides accomplishing it much more speedily, than under small ones, entailing disadvantage upon all concerned.

For the extension and completion of the north jetty under one contract, I respectfully recommend that $600,000 be appropriated for application during the fiscal year ending June 30, 1896.

The building of the dike on South Island is under the immediate charge of Mr. Reid Whitford, assistant engineer.

The bay is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1893, balance unexpended		$67,470.19
June 30, 1894, amount expended during fiscal year		34,588.49
July 1, 1894, balance unexpended		32,881.70
July 1, 1894, outstanding liabilities	$2,949.88	
July 1, 1894, amount covered by uncompleted contracts	27,213.81	
		30,163.69
July 1, 1894, balance available		2,718.01
Amount (estimated) required for completion of existing project		2,181,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		600,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	2,000	Turpentine, crude and spirits of, and rosin	38,700
Wool	5	Lumber	103,000
Rice	5,400	General merchandise	105,000
Vegetables, including truck	350	Total	268,640
Poultry and eggs	10		
Fish and shellfish	4,175		
Shingles	10,000		

Ten thousand passengers were carried during the year.

Freight transported.

Calendar year ending December 31—	Tons.
1885	125,000
1889	196,754
1890	261,029
1891	261,370
1892	271,986

Winyaw Bay, South Carolina.

APPROPRIATED.

Date.	Amount.	Aggregate.
Aug. 5, 1886	$18,750	$18,750
Aug. 11, 1888	100,000	118,750
Sept. 19, 1890	100,000	218,750
July 13, 1892	100,000	318,750

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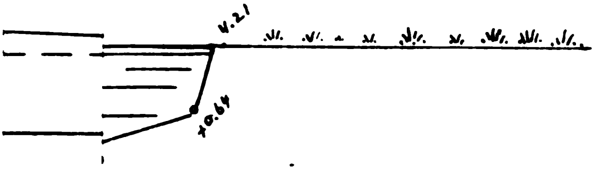

:COMPANY ANNUAL REPORT

MAJOR, CORPS OF ENGINEERS, U. S. A.

The Friedenwald Co., Photo-Lith., Balto., Md.

Eng. 58 8.

UNIV. OF MICH.

EXPENDED.

To June 30—		To June 30—	
1887	$2,625.42	1891	$32,836.88
1888	3,751.72	1892	186,975.79
1889	6,980.26	1893	272,528.88
1890	20,027.45		

L 22.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

George G. Green.—Report was made December 1, 1893, by the master of the U. S. revenue cutter *Colfax* that the wreck of the three-masted schooner *George G. Green* lay in 8½ fathoms of water 7 miles NWW. ½ mag. from Frying Pan Light-Ship with all her spars standing and gaffs at water's edge with sails attached.

As this wreck lay 16 miles from the entrance to the Cape Fear River and directly in the track of vessels between the entrance to the river and Frying Pan Shoals Light-Vessel, it was reported to the Chief of Engineers to be a dangerous obstruction to navigation, and December 15, 1893, its removal was authorized by the Secretary of War, and an allotment of $500 made for that purpose.

In April, 1894, an attempt to blow out the masts was made by means of the U. S. tug *Easton*, from the Cape Fear River improvement, but the sea was too rough to permit it to be accomplished.

It appears from information received from the Hydrographic Office, Navy Department, that the U. S. dynamite gunboat *Vesuvius*, April 21, 1894, blew out and broke up the three masts of this wreck and left 6½ fathoms of water over the hull.

Enchantress.—December 18, 1893, the schooner *Enchantress*, which was wrecked in the storm of October 13, 1893, and lay dismasted and bottom up with a part of her cargo of railroad ties at the westerly verge of the channel of the Cape Fear River immediately below Wilmington, was reported to the Chief of Engineers to be a dangerous obstruction, and its removal was authorized by the Secretary of War December 20, 1893, and $1,000 allotted for that purpose.

As this wreck is so far from mid-channel, and as it was possible that the owners of the cargo would remove it, its removal with the above allotment was deferred and is now in progress by the owners of the cargo.

Wreck off Cape Hatteras.—December 13, 1893, a sunken three-masted schooner was reported lying in 12 fathoms, with mast and topmasts out of water, 10½ miles NE. ¼ N. from Cape Hatteras in direct courseway from Hatteras Shoals to the Capes of Virginia. It was reported to the Chief of Engineers to be a dangerous obstruction to navigation, and January 10, 1894, its removal was authorized by the Secretary of War and an allotment of $1,500 made for that purpose. The weather at that time was not favorable for its removal, and unless it has been removed by the U. S. dynamite gunboat *Vesuvius*, which cruised along the coast removing wrecks in April, its removal will be undertaken in July, 1894.

Wreck off Cape Lookout.—December 28, 1893, a sunken wreck, with one mast standing about 15 feet out of the water, was reported bearing about 12 miles S. by E. magnetic from Cape Lookout Light-House, in the track of vessels in 6 fathoms of water. When search was made for this wreck, January 16, 1894, it could not be found, but information was at that time received that there were believed to be two other dangerous sunken wrecks in that vicinity, and January 16, 1894, an allotment of $300 was made for searching for the three wrecks.

On June 19, 1894, the following letter was received from Capt. Gabrielson, commanding the U. S. revenue cutter *Colfax*, which disposes of the wrecks in that locality:

REVENUE MARINE STEAMER COLFAX,
Morehead City, N. C., June 19, 1894.

SIR: While cruising in the vicinity of Cape Lookout Shoals on Saturday last I made examination of the spars and wreckage attached to the submerged wrecks on the following magnetic bearings and distances from Cape Lookout Light-House, viz: First, N. ½ E., 13½ miles; second, N. ⅛ W., 13¼ miles; third, N. ¼ W., 12¼ miles. The depth of water varied from 6½ to 8 fathoms on half-ebb tide. Finding nothing that would interfere with the safe navigation of vessels, I removed all the spars with wreckage and towed same into Lookout Bight.

Very truly,

ERIC GABRIELSON,
Capt., U. S. R. M.

Maj. W. S. STANTON,
U. S. Engineer Corps.

APPENDIX M.

IMPROVEMENT OF WACCAMAW AND LUMBER RIVERS, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

REPORT OF CAPT. FREDERIC V. ABBOT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Waccamaw River, North Carolina and South Carolina.
2. Lumber River, North Carolina and South Carolina.
3. Little Pedee River, South Carolina.
4. Great Pedee River, South Carolina.
5. Clark River, South Carolina.
6. Mingo Creek, South Carolina.
7. Santee River, South Carolina.
8. Wateree River, South Carolina.
9. Congaree River, South Carolina.
10. Harbor at Charleston, S. C.
11. Ashley River, South Carolina.
12. Wappoo Cut, South Carolina.
13. Edisto River, South Carolina.
14. Salkehatchie River, South Carolina.
15. Beaufort River, South Carolina.
16. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 2, 1894.

GENERAL: I have the honor to transmit herewith the annual reports for the fiscal year ending June 30, 1894, for the works of improvement of rivers and harbors which have been in my charge.

Very respectfully, your obedient servant,

FREDERIC V. ABBOT,
Captain of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

M 1.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 848, Annual Report for 1880.
For map of river see p. 1200, Annual Report for 1889.

ORIGINAL CONDITION.

In 1880 this stream was navigable for 12-foot boats at all stages of water from Georgetown 23 miles to Bull Creek, and at high water 4 miles farther to Buck's Lower Mills; thence for 7-foot draft boats at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot draft boats, at ordinary winter water, 68 miles to Reeves Ferry; thence an obstructed channel with 3 feet at high water for 30 miles to Lake Waccamaw.

PLAN OF IMPROVEMENT.

The project provides for a channel 12 feet deep at all stages of water with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw, at an estimated cost of $138,400.

WORK PRIOR TO JUNE 30, 1893.

At eight shoals jetties made of piles and plank were put in. The river had been snagged between points no miles and 121 miles above the mouth; since June 30, 1884, 23,417 obstructions having been removed. Before June 30, 1884, the records are not sufficiently in detail to give exact figures.

Dividing the total expenditures, $54,033.52 for all purposes, between June 30, 1884, and June 30, 1893, by the above number of obstructions removed, shows the average cost for that period to have been $2.31 for each obstruction.

WORK OF PAST YEAR.

Work was carried on till August 15, 1893, with United States plant and hired labor. From that time to November 2, 1893, with a steam hoister hired from Mrs. Mary A. Daggett and operated by the United States. The river has been quite thoroughly cleared for a width of 40 feet and a depth of 3 feet at low water between points 49 miles and 110 miles above the mouth. The average cost of removing obstructions was 53 cents each. For details of work done and commercial statistics, reference is made to the report of my assistant engineer, Mr. Reid Whitford, who has shown his usual ability in conducting the work.

REMARKS.

One new transportation line has been established on this river during the year.

The balance of $1,046.90 on hand July 1, 1894, will be applied to care of United States plant till a new appropriation is made by Congress.

During the year the freight passing over this stream has aggregated 99,298 tons.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 14, 1880	$15,000.00
Approved March 3, 1881	10,000.00
Passed August 2, 1882	4,400.00
Approved July 5, 1884	6,000.00
Approved August 5, 1886	15,000.00
Of August 11, 1888	15,000.00
Approved September 19, 1890	12,500.00
Approved July 13, 1892	10,000.00
Total	87,900.00
Total expenditures, including June 30, 1894	86,853.10

Money statement.

July 1, 1893, balance unexpended	$4,801.30
June 30, 1894, amount expended during fiscal year	3,754.40
July 1, 1894, balance unexpended	1,046.90
July 1, 1894, outstanding liabilities	101.05
July 1, 1894, balance available	945.85
Amount (estimated) required for completion of existing project	50,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

United States Engineer Office,
Georgetown, S. C., June 30, 1894.

Captain: I have the honor to report as follows on Waccamaw River, North and South Carolina, for fiscal year ending June 30, 1894:

Work of snagging and clearing banks was carried on by United States hand hoister and hired labor till August 15, 1893, when operations were continued by using a steam hoister hired from Mrs. Mary A. Daggett, with a crew supplied by the United States. Active work by hired hoister ceased November 2, 1893. Operations were carried on between points 110¼ and 49 miles above mouth, maintaining the previously cleared channel below Conway and extending the improvement above that place. The following total number of obstructions were removed, thoroughly clearing the channel to a width of 40 and a depth of 3 feet at low water: From the channel, 587 logs, 324 stumps, 447 large snags, and 8¼ cords small snags; from the banks, 963 trees and 42 cords of brush cut. Of the total amount expended, six-tenths were used on the channel and four-tenths on banks. Each obstruction cost, approximately, 53 cents. The owners and captains of the steamers express themselves as being highly pleased with the work. One new transportation line has been established on this river during the year.

RECOMMENDATIONS.

It is respectfully recommended that work be carried on above Conway as it has been this year, with probably some dredging which may be necessary, and the existing width and depth below Conway be maintained at least.

COMMERCE.

The following statement was made up from the best information that could be obtained by R. G. Dusenbury, timekeeper; from D. T. McNeill, general agent and treasurer Waccamaw line steamers; Messrs. W. L. Buck & Co., lumber and shingle dealers, and Messrs. P. R. Lachicotte & Sons, rice millers. There are other freights on the Waccamaw River, but it was impossible to get any approximate estimate of them, as they are carried by pole boats and small craft of which no account is kept.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin.....barrels..	76,000	13,300	$228,000	78,000	15,600	$156,000
Tar.....do....	557	56	1,114	407	81	814
Spirits of turpentine.....do....	12,000	2,250	240,000	14,000	2,800	220,000
Turpentine, crude.....do....	6,000	840	15,000	4,000	600	8,000
Cotton.....bales..	5,500	1,375	275,000	5,000	1,250	175,000
Timber.....sticks..	9,547	14,326	40,980	10,640	19,152	53,200
Lumber.....feet..	8,800,000	18,333	132,000	9,000,000	15,000	117,000
Shingles.....	9,800,000	4,900	78,400	9,200,000	4,600	73,600
Rough rice.....bushels..	122,000	2,684	152,500	155,100	2,806	178,365
Rice, clean.....barrels..	12,000	1,950	195,000	15,508	2,714	271,390
Miscellaneous articles, tallow, eggs, wax, game, poultry, etc.	.....	1,231	123,118	.....	1,500	75,000
Total.....	.....	61,245	1,481,112	.....	66,103	1,328,369
INWARD FREIGHTS.						
General merchandise.....	.....	15,000	750,000	.....	17,000	850,000
Grand total.....	.....	76,245	2,231,112	.....	83,103	2,178,369

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin.....barrels..	53,167	10,633	$106,334	72,220	14,444	$144,440
Spirits of turpentine.....do....	10,893	2 179	163,395	14,744	2,948	258,020
Crude turpentine.....do....	1,330	266	2,660	4,740	948	9,480
Tar.....do....	1,238	248	2,476	2,388	477	4,776
Cotton.....bales..	17,230	4,307	603,050	5,668	1,417	198,380
Rough rice.....bushels..	195,279	4,491	195,279	93,000	2,139	106,950
Rice, clean.....barrels..	19,945	3,490	299,175	6,600	1,155	115,500
Rice flour.....bushels..	25,000	250	7,500	25,000	250	7,500
Hides.....bales..	3	1	200	6	2	400
Wool.....do....	5	1	400	34	13	5,100
Clams.....barrels..	2,121	424	8,484	3,091	618	12,364
Fish.....do....	363	19	95	430	21	2,150
Lumber.....feet. B. M..	6,700,000	11,167	100,500	9,158,067	15,263	137,371
Timber.....pieces..	10,000	20,000	50,000	37,463	37,463	168,583
Shingles.....	7,000,000	3,500	56,000	9,244,291	4,622	73,954
Total.....	.....	60,976	1,595,548	.....	81,780	1,244,968
INWARD FREIGHTS.						
General merchandise.....	.....	10,000	500,000	.....	17,518	875,900
Grand total.....	.....	70,976	2,095,548	.....	99,298	2,120,868

This shows an increase over last year's statement of 28,322 tons. The commerce has been carried on by seagoing vessels of about 300 tons and steamers of 15 to 300 tons.

EMPLOYÉS.

Much credit is due Mr. B. T. Daggett, overseer, and C. J. Banta, timekeeper, for their usual efficient and satisfactory work.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Georgetown, S. C., from January 1, 1888, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888......	352	124, 155	2, 818	2	479	14	1	81	8	355	124, 715	2, 840
1889......	365	128, 705	2, 920	2	424	10	1	149	7	368	129, 278	2, 943
1890......	385	165, 785	3, 150	6	1, 346	42	1	106	6	392	167, 237	3, 198
1891......	420	191, 651	4, 035	1	245	7	2	292	14	423	192, 188	4, 056
1892......	453	215, 087	4, 610	1	249	7	2	439	14	456	215, 775	4, 631
1893......	506	318, 156	4, 813	1	241	7	....	....	....	507	318, 397	4, 820
CLEARED.												
1888......	342	121, 715	2, 735	8	1, 835	55	1	81	8	351	123, 631	2, 798
1889......	357	126, 965	2, 856	6	1, 494	45	1	149	7	364	128, 608	2, 908
1890......	372	160, 458	3, 069	9	1, 978	63	2	355	13	383	162, 791	3, 145
1891......	384	164, 562	3, 986	9	2, 719	69	1	149	7	394	167, 420	4, 062
1892......	396	187, 963	4, 094	5	1, 173	33	3	537	19	404	189, 673	4, 146
1893......	428	193, 763	4, 318	4	985	27	1	174	7	433	194, 922	4, 352

Commerce, foreign and domestic.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$3, 125, 000	$2, 750, 000	$32. 44
1889	3, 265, 000	2, 975, 000	....
1890	3, 454, 000	3, 175, 000	60. 54
1891	3, 291, 407	6, 895, 000	11. 64
1892	3, 989, 040	7, 347, 568	14. 82
1893	4, 100, 040	7, 349, 575	7. 23

Total commerce, 1888	$5, 875, 000
Total commerce, 1889	6, 240, 000
Total commerce, 1890	6, 629, 000
Total commerce, 1891	9, 809. 077
Total commerce, 1892	11, 336, 608
Total commerce, 1893	11, 449, 615

HENRY C. SMITH,
Deputy Collector.

M 2.

IMPROVEMENT OF LUMBER RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1102, Annual Report for 1887. For map of river see p. 1198, Annual Report for 1890.

ORIGINAL CONDITION.

The river was obstructed by logs, snags, stumps, overhanging trees, and in places by sand bars. Long reaches were in fair condition. That portion of the river between Lumberton and the North Carolina line was crossed by five low bridges without drawspans, and one moderately high railroad bridge near Lumberton. In South Carolina the river was crossed by two bridges without draws.

PLAN OF IMPROVEMENT.

The project provides for improving the river for steamboats from its mouth to Lumberton, a distance of 70.8 miles, by snagging and clearing the banks, at an estimated cost of $35,000.

WORK PRIOR TO JUNE 30, 1893.

The parties operating the Fair Bluff and Ivy Bluff bridges had provided satisfactory drawspans. The bridges at Griffins and Mathews had been discontinued. The bridge at Phillips will be provided with a draw as soon as the county commissioners operating it can raise the necessary funds. The Atlantic Coast Line had completed, except for fendering, a new steel drawbridge to replace the old composite fixed bridge. The new bridge will have a clear opening of over 70 feet.

The river was quite thoroughly cleared by plant owned and operated by the United States, for a width of 40 feet and depth of 3 feet at low water between points no miles and 71 miles above the mouth, 21,354 obstructions having been removed. Dividing the total expenditures to June 30, 1893, for all purposes, by the above number of obstructions removed, shows the average cost to have been $0.61 for each obstruction removed. A hand snag boat had been built.

WORK OF PAST YEAR.

Very little work was done, as the river was in fair condition. The plant was cared for and the river examined to see that it did not need working over.

REMARKS.

No new line of transportation has been established during the year. Two small steamers have run irregularly on this river during the year. During the year freights passing over this stream have aggregated 10,550 tons.

The balance of $87.93, on hand July 1, 1894, will be applied to care of United States plant till a new appropriation is made by Congress.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress:—	
Of August 11, 1888	$5,000.00
Approved September 19, 1890	5,000.00
Approved July 13, 1892	5,000.00
Total	15,000.00
Total expenditures, including June 30, 1894	14,912.07

For table of commercial statistics, furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$1,932.04
June 30, 1894, amount expended during fiscal year	1,844.11
July 1, 1894, balance unexpended	87.93
July 1, 1894, outstanding liabilities	56.00
July 1, 1894, balance available	31.93
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Lumber River, North and South Carolina, for fiscal year ending June 30, 1894:

Active work by United States hand hoister and hired labor ceased on July 1, 1893, at the head of navigation, after removing 37 logs, 10 stumps, 12 large snags, 2¼ cords small snags, and 8 trees. When the above special obstructions, which were reported as being particularly in the way of navigation, had been removed, the plant was laid up for repairs. The river has been examined with the view of keeping it clear of such obstructions as might dangerously block navigation.

RECOMMENDATIONS.

It is respectfully recommended that work be continued as heretofore, and that, in addition, the river be dredged where needed.

COMMERCE.

The following statement was made up from the best information that could be obtained by Mr. R. G. Dusenbury, timekeeper, from the most prominent business men, among whom may be mentioned Messrs. Barnes, Butters, Smith, and Nichols:

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
Timber ..... sticks..	3,000	4.500	$12,600	5,000	6,000	$18,000
Fertilizers		100	2,000		200	4,000
General merchandise		500	25.000		600	30,000
Total		5,100	39,600		6,800	52,000

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTGOING FREIGHTS.						
Cotton ..... bales..	500	1,250	$17,500	400	100	$14,000
Eggs ..... crates..	200	3	400			
Fowls ..... dozen..	50	1	150			
Timber ..... logs..	5,500	5,500	16,500			
Lumber ..... feet..				150,000	250	3,000
Logs				9,600	9,600	28,800
		6,754	34,550		9,950	45,800
INCOMING FREIGHTS.						
General merchandise		400	20,000			
Fertilizers, merchandise, etc					600	30,000
Total		7,154	54,550		10,550	75,800

This shows an increase of 3,396 tons over last year. Freights have been transported by two small steamers belonging to Butters Lumber Company, pole boats, and rafts.

No new line of transportation established on this river during the past year.

EMPLOYÉS.

Mr. R. G. Dusenbury, overseer and timekeeper, has shown his usual cheerfulness and efficiency in the discharge of his duties.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 3.

IMPROVEMENT OF LITTLE PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1111, Annual Report for 1887. For map of river see p. 1214, Annual Report for 1890.

ORIGINAL CONDITION.

The river was much obstructed by snags and overhanging trees, and in places was divided into several branches, in neither of which there was a good channel, and by 10 bridges without draws.

PLAN OF IMPROVEMENT.

It is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, and pole-boat navigation thence to Little Rock, at an estimated cost of $50,000.

WORK PRIOR TO JUNE 30, 1893.

The bridges on that part of the river on which steamboat navigation is to be provided had been supplied with draw openings. The river had been snagged between points no miles and 113 miles above the mouth, 15,160 obstructions having been removed. Dividing the total expenditures to June 30, 1893, for all purposes by the number of obstructions removed shows the average cost to have been 83 cents for each obstruction removed. A hand snag boat had been built and is now on hand in good order.

WORK OF PAST YEAR.

No work was done except care of plant and careful watching of the river to see if it needed work that could be accomplished with the small balance on hand.

REMARKS.

No new transportation line has been established on this river during the year. One steamer has run regularly, and two others irregularly.

The balance of $781.82 on hand July 1, 1894, will be applied to care of plant till a new appropriation is made by Congress. During the year the freight passing over this stream has aggregated 8,375 tons.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Of August 11, 1888	$5,000.00
Approved September 19, 1890	5,000.00
Approved July 13, 1892	5,000.00
Total	15,000.00
Total expenditures, including June 30, 1894	$14,218.18

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$2,416.14
June 30, 1894, amount expended during fiscal year	1,634.32
July 1, 1894, balance unexpended	781.82
July 1, 1894, outstanding liabilities	279.00
July 1, 1894, balance available	502.82
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Little Pedee River, South Carolina, for fiscal year ending June 30, 1894:

Active operations were not carried on during the present fiscal year, except so far as maintaining with the small balance left after last year's work the improvement to navigation, which had previously been effected. Minor repairs have been made and plant cared for.

RECOMMENDATIONS.

It is respectfully recommended that snagging be continued, but after a detailed survey future work be done first in preference at the narrows near the mouth, and that such other places be dredged as may be needed to provide a good navigable channel for the steamers which are running on this stream.

COMMERCE.

The following statement was made up by Mr. R. G. Dusenbury, timekeeper, from information furnished by the captains of steamers, J. W. Holliday & Son, and flatmen on the river:

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin .... barrels..	3,920	686	$5,880	5,000	1,000	$10,000
Spirits of turpentine .... do....	408	77	8,160	636	127	9,540
Cotton .... bales..	310	78	15,500	600	150	21,000
Ton timber .... sticks..	2,200	3,300	9,240	4,240	5,088	15,264
Shingles	30,000	15	240	20,000	10	160
Total	....	4,156	39,020	....	6,375	55,964
INWARD FREIGHTS.						
General merchandise	....	458	13,740	....	740	37,000
Grand total	....	4,614	52,760	....	7,115	92,964

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin .... barrels.	4,400	880	$8,800	5,300	900	$10,000
Spirits of turpentine .... do....	750	150	11,250	800	175	14,000
Cotton .... bales..	700	175	24,500	700	150	24,000
Ton timber .... sticks..	....	....	....	6,000	6,000	18,000
Timber .... do....	4,050	4,050	12,150	....	....	....
Shingles	20,000	10	160	....	....	....
Eggs .... crates..	275	4	550	....	....	....
Pease .... bushels..	300	9	375	....	....	....
Cross-ties .... number..	....	....	....	10,000	250	3,000
Total	....	5,278	57,785	....	7,475	69,000
INWARD FREIGHTS.						
General merchandise, fertilizers, etc	....	875	43,750	....	900	45,000
Grand total	....	6,153	101,535	....	8,375	114,000

This shows an increase of 2,222 tons over last year's statement.

The commerce has been carried on by one steamer running regularly and two steamers making irregular trips, towboats, and rafts.

No new line of transportation has been established on this river during the year.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 4.

IMPROVEMENT OF GREAT PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For prelimary examination see p. 753, Annual Report for 1873. For special description, see p. 845, Annual Report for 1880, and p. 723, Annual Report for 1879. For map of river see p. 1180, Annual Report for 1889.

ORIGINAL CONDITION.

The river was dangerously obstructed by snags and logs everywhere. Boats drawing 9 feet of water were able to reach Smith Mills, 52 miles above the mouth. Those drawing 3½ feet could get 54 miles farther up at low water, to Little Bluff, or at high water, to Cheraw, 172 miles from the mouth.

PLAN OF IMPROVEMENT.

The project provides for a thoroughly cleared 9-foot navigation to Smith Mills and a 3½-foot navigation to Cheraw at all stages of water, at an estimated cost of $117,000.

WORK PRIOR TO JUNE 30, 1893.

The river had been snagged between points no miles and 172 miles above the mouth; since June 30, 1884, 22,941 obstructions having been removed. Before June 30, 1884, the records are not sufficiently in detail to give exact figures. Dividing the total expenditures, $64,478.25, from June 30, 1884, to June 30, 1893, by the above number of obstructions removed, shows the average cost during that period to have been $2.81 for each obstruction. A good steam snag boat had been built and is now on hand. It needs a new hull, but all the machinery is in first-class order.

WORK OF PAST YEAR.

The river was quite thoroughly cleared by plant owned and operated by the United States for a width of 80 feet and depth of 4 feet at low water between points no miles and 127 miles above the mouth. The average cost of removing obstructions was 82 cents each.

For details of work done and commercial statistics, reference is made to the report of my assistant engineer, Mr. Reid Whitford, who has shown marked ability in directing and controlling the working party and maintaining the efficiency of the plant.

REMARKS.

No new transportation line has been established on this river during the year. With the balance of $2,147.63 on hand July 1, 1894, snagging will be continued, the worst obstructions being removed first. During the year the freight passing over this stream has aggregated 91,025 tons.

This river is in the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 14, 1880	$7,000.00
Approved March 3, 1881	6,000.00
Passed August 2, 1882	6,000.00
Approved July 5, 1884	8,000.00
Approved August 5, 1886	20,000.00
Of August 11, 1888	20,000.00
Approved September 19, 1890	12,500.00
Approved July 13, 1892	10,000.00
Total	89,500.00
Total expenditures, including June 30, 1894	87,352.37

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$6,178.28
June 30, 1894, amount expended during fiscal year	4,030.65
July 1, 1894, balance unexpended	2,147.63
July 1, 1894, outstanding liabilities	219.00
July 1, 1894, balance available	1,928.63
Amount (estimated) required for completion of existing project	27,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	27,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Great Pedee River, South Carolina, for fiscal year ending June 30, 1894:

Snagging and clearing banks continued by United States steam hoister and hired labor. From the channel there were removed 348 logs, 115 stumps, 206 large snags, 3½ cords small snags. From the banks 578 trees and 6½ cords of brush cut. Work extended over the river from the mouth to 127 miles above, quite thoroughly clearing the channel. Of the total amount expended, five-tenths were used on the channel and five-tenths on the banks. Each obstruction cost approximately 82 cents. Operations were greatly delayed by high freshets during the year.

REMARKS.

The improvement of the river has been decidedly marked, as captains of the river steamers and others state

RECOMMENDATIONS.

It is respectfully recommended that the same character of work be carried on, with additional dredging of shoals where needed, till a thoroughly cleared channel is completed sufficiently deep to permit uninterrupted navigation throughout the whole year from mouth of river to town of Cheraw.

COMMERCE.

The following statement was obtained by Mr. R. G. Dusenbury, timekeeper, from Maj. B. A. Munnerlyn, agent South Carolina Steamboat Company, William L. Buck & Co., lumber dealers, and D. R. Smith, lumber and timber dealer:

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	5,926	1,483	$296,300	5,780	1,445	$202,300
Clean rice .... barrels..	16,342	2,656	265,558	16,560	2,898	280,750
Rough rice .... bushels..	83,000	1,827	103,750	88,000	1,524	101,200
Rosin .... barrels..	35,800	6,265	50,120	30,000	6,000	60,100
Spirits of turpentine .... do....	4,014	652	80,280	5,436	1,087	81,540
Cypress shingles	6,705,987	3,353	53,640	6,970,000	3,485	55,700
Lumber, cypress .... feet..	3,000,000	6,250	45,000	3,100,000	5,166	46,500
Cypress logs .... do...	22,547	33,821	81,169	....	....	....
Wood .... cords..	225	225	563	2,000	2,000	4,000
Hides, wool, staves, etc	....	250	7,500	352	352	17,000
Timber .... sticks..	....	....	....	51,640	61,968	216,558
Cross-ties	....	....	....	18,000	144	5,400
Total	....	56,782	983,880	....	86,069	1,080,998
INWARD FREIGHTS.						
General merchandise	....	5,562	383,450	....	6,402	320,100
Grand total	....	62,344	1,367,330	....	92,471	1,401,098

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin..........barrels..	21, 345	4, 269	$42, 690	24, 534	4, 906	$49, 068
Spirits of turpentine..........do....	3, 391	678	50, 865	7, 211	1, 442	126, 192
Cotton..........bales..	3, 610	903	126, 350	6, 110	1, 027	213, 850
Crude turpentine..........barrels..	....	....	....	1, 340	268	2, 680
Ton timber..........sticks..	58, 949	58, 949	176, 847	30, 000	60, 000	165, 000
Shingles..........	9, 163, 000	4, 581	73, 304	6, 000, 000	3, 000	36, 000
Eggs and poultry..........crates..	275	4	550	....	7	1, 000
Peas..........bushels..	300	9	375	....	....	....
Rice, rough..........do....	206, 343	4, 746	206, 343	52, 309	1, 203	60, 155
Lumber..........feet, B. M.	4, 000, 000	6, 667	60, 000	4, 000, 000	6, 667	80, 000
Wood..........cords..	2, 800	2, 800	5, 600	2, 800	2, 800	5, 600
Tar..........barrels..	850	170	1, 700	1, 200	240	2, 400
Cross-ties..........	33, 000	2, 640	9, 900	48, 750	1, 215	14, 625
Miscellaneous articles, hides, wool, staves, etc..........	....	400	20, 000	....	450	22, 500
Total..........	....	86, 816	774, 524	....	83, 225	779, 070
INWARD FREIGHTS.						
General merchandise..........	....	7, 845	392, 350	....	7, 800	390, 000
Grand total..........	....	94, 661	1, 166, 874	....	91, 025	1, 169, 070

This shows an increase in value over that given in 1893, but decrease in tonnage. There are other freights transported by pole boats and smaller craft of which no account whatever could be obtained. Commerce has been carried on by seagoing schooners of 250 to 300 tons, tugboats, and steamers *Maggie*, *Ruth*, and *Driver* to Port Harrelson and Smith Mills, and steamers *Merchant*, *John M. Cole*, and *Santee* to Cheraw, head of navigation.

EMPLOYÉS.

Mr. Homer Jacobs, overseer; J. W. Harllee, engine-driver, and J. P. Rumley, timekeeper, have been faithful and efficient in the discharge of their duties.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 5.

IMPROVEMENT OF CLARK RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1109, Annual Report for 1887. For map of river see p. 1204, Annual Report for 1890.

ORIGINAL CONDITION.

This river is really the southern mouth of Lynch River. Its upper end was entirely choked by a tangled mass of driftwood and fallen trees. The lower part was fairly clear of obstructions.

PLAN OF IMPROVEMENT.

The project provides for closing the northern mouth of Lynch River and thoroughly snagging Clark River, at an estimated cost of $7,500.

WORK PRIOR TO JUNE 30, 1893.

The river was roughly cleared by plant owned and operated by the United States for a width of 40 feet and depth of 3 feet at low water between points no miles and 7 miles above the mouth, 14,290 obstructions having been removed. Dividing the total expenditures to June 30, 1893, for all purposes, by the above number of obstructions removed, shows the average cost to have been 50 cents for each obstruction.

WORK OF PAST YEAR.

No work was done on account of lack of funds. The last appropriation completed the estimated cost. All that is needed has been done, unless Lynch River is improved for steamers as recommended in my report of December 2, 1892, Ex. Doc. 125, H. R., Fifty-second Congress, second session.

REMARKS.

No new line of transportation has been established on this river during the year.

The balance of $35.42 on hand July 1, 1894, is too small to admit of any work on the river.

During the year the freight passing over this stream has aggregated about 7,000 tons.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Of August 11, 1888	$2,500.00
Approved September 19, 1890	2,500.00
Approved July 13, 1892	2,500.00
Total	7,500.00
Total expenditures, including June 30, 1894	7,464.58

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$413.81
June 30, 1894, amount expended during fiscal year	378.39
July 1, 1894, balance unexpended	35.42

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Clark River, South Carolina, for fiscal year ending June 30, 1894:

No snagging was done on this river during the present year, because of the small amount left available. The river was examined with the view of removing such special obstructions as might particularly interfere with the improvement so far effected.

COMMERCE.

The commerce remains about the same as last year, and no more can be expected till Lynch River is opened for navigation.

REMARKS.

As the total amount of the estimate for Clark River has been expended, it can only be suggested that Lynch River, which forms the upper part of Clark River, be improved so as to permit the commerce along that stream to come down into Great Peedee River via Clark River. The latter river is the best outlet for Lynch into Great Peedee, and when the Clark and Lynch are once fairly opened for navigation they will become commercially important. In this way the productive country along these streams will be furnished with transportation facilities, which are badly needed, so as to save the people the hauling of their products and supplies expensively long distances to markets.

RECOMMENDATIONS.

It is recommended that a good navigable channel be provided and maintained, so as to permit steamers to run uninterruptedly.

Very respectfully, your obedient servant,

Reid Whitford,
Assistant Engineer.

Capt. Frederic V. Abbot,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Previous commerce.

Articles.	1892.			1893.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Resin .... barrels..	5,000	1,000	$10,000	4,000	800	$8,000
Spirits of turpentine .... do...	....	....	....	500	100	7,500
Cotton .... bales..	....	....	....	310	78	10,850
Timber .... sticks..	4,447	5,336	16,009	6,500	6,500	19,500
	....	6,336	26,009	....	7,478	45,850
INWARD FREIGHTS.						
Fertilizers	....	250	2,000	....	....	....
General merchandise	....	....	....	....	150	7,500
Total	....	6,586	28,009	....	7,628	53,350

M 6.

IMPROVEMENT OF MINGO CREEK, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see p. 1106, Annual Report for 1887. For map of creek, see p. 1202, Annual Report for 1890.

ORIGINAL CONDITION.

The creek was much obstructed by snags and overhanging trees, and was crossed by one bridge without a draw.

PLAN OF IMPROVEMENT.

The project provides for improving the creek for steamboats from its mouth to Williams Landing, and for pole boats at high water up to the head of navigation, by snagging and clearing the banks, at an estimated cost of $17,000.

WORK PRIOR TO JUNE 30, 1893.

The creek was snagged between points no miles and 15 miles above the mouth, 12,331 obstructions having been removed. The parties operating Mingo bridge had put in a drawspan. Dividing the total expenditures to June 30, 1893, for all purposes, by the above number of obstructions removed, shows the average cost to have been 93 cents for each obstruction. A good hand snag boat had been built and is now on hand in good order.

WORK OF PAST YEAR.

A snag boat was run over the creek rapidly taking out a few obstructions. The United States plant was cared for.

REMARKS.

One new line of transportation has been established on this creek during the year.

The balance of $31.06 on hand July 1, 1894, will be applied to care of United States plant till a new appropriation is made by Congress.

During the year the freight passing over this stream has aggregated 114,375 tons.

This creek is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Of August 11, 1888	$5,000.00
Approved September 19, 1890	5,000.00
Approved July 13, 1892	3,000.00
Total	13,000.00
Total expenditures, including June 30, 1894	12,968.94

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$1,453.98
June 30, 1894, amount expended during fiscal year	1,422.92
July 1, 1894, balance unexpended	31.06
Amount (estimated) required for completion of existing project	4,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Mingo Creek, South Carolina, for fiscal year ending June 30, 1894:

The improvement heretofore effected was maintained as far as possible with the small amount of funds available. In this work there were removed 3 stumps, 20 trees, 14 large snags, over the entire length of the creek.

REMARKS.

The creek has been very greatly improved by the previous work of the United States, so the captains of the steamers state, but there are still left other obstructions and some sand shoals to be removed before it is completed to their entire satisfaction.

RECOMMENDATIONS.

It is respectfully recommended that a thoroughly cleared channel be provided and maintained by snagging and dredging, if needed, so that the steamers may run uninterruptedly throughout the lowest stages of water.

COMMERCE.

The following letter and statement from Messrs. F. Rhem & Sons explain themselves. The above-mentioned firm controls a large portion of the commerce on the creek, and it is supposed that they are thoroughly familiar with the amount and value of exports and imports.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
EXPORTS.						
Spirits of turpentine..........barrels..	11,000	2,750	$220,000	12,000	3,000	$192,000
Rosin..........do....	66,000	11,550	145,000	70,000	14,000	175,000
Crude turpentine..........do....	5,000	1,000	25,000	5,000	1,000	20,000
Wood..........cords..	6,000	6,000	15,000	10,000	10,000	30,000
Staves..........	350,000	700	1,400	750,000	1,750	3,500
Hoop poles..........	50,000	50	5,000	50,000	50	6,000
Cotton..........bales..	4,500	1,125	202,500	7,000	1,750	245,000
Shingles..........	600,000	300	5,000	200,000	30	1,400
Other produce, including wool..........	....	400	20,000	....	450	25,000
Lumber, cross-ties, etc..........	....	12,000	60,000	....	15,000	75,000
Total..........	....	35,875	698,900	....	47,030	772,900
IMPORTS.						
General merchandise..........	....	7,000	350,000	....	8,250	412,500
Grand total..........	....	42,875	1,048,900	....	55,280	1,185,400

Articles.	1893.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Spirits of turpentine..........barrels..	12,000	2,400	$216,000
Rosin..........do....	70,000	14,000	185,000
Crude turpentine..........do....	5,000	1,250	15,000
Cypress, oak, and pine staves..........	75,000	190	4,500
Wood..........cords..	12,000	12,000	36,000
Hoop poles..........	25,000	25	4,500
Cotton..........bales..	7,500	1,850	300,000
Shingles..........	700,000	350	5,600
Other produce..........tons..	....	600	35,000
Lumber, timber, etc..........	....	45,000	200,000
Total..........	....	77,665	1,001,600
INWARD FREIGHTS.			
General merchandise..........	....	17,000	750,000
Grand total..........	....	94,665	1,751,600

RHEMS, S. C., *May 1, 1894.*

SIR: Please find inclosed report of commerce of Mingo River, commencing May 1, 1893, and ending May 1, 1894.

This report shows that the tonnage is greater, while the value is less. This is accounted for in this way—the lumber interest has increased and the low prices of naval stores and cotton causes the shrinkage. We have nothing of interest to report except the formation of the Black Mingo and River Steamboat Company, which was organized in January and is successfully running the steamers as far as Mingo bridge. The two small sand bars and a few logs keep them from plying the river to Williams Landing, which have not been removed since our last report. (We then fully explained the trouble.) Above the bridge certainly needs another appropriation, and we respectfully ask that Congress give the people dependent in that section one.

Yours, very respectfully,

F. RHEM & SONS.

REID WHITFORD,
U. S. Assistant Engineer.

Commerce.

Articles.	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Spirits .... barrels..	10,000	2,500	$180,000
Rosin .... do....	60,000	15,000	120,000
Crude turpentine .... do....	4,000	1,000	3,000
Cypress, oak, and pine staves	750,000	300	7,500
Wood .... cords..	15,000	15,000	45,000
Hoop poles .... number..	75,000	75	7,500
Cotton .... bales..	5,000	1,000	200,000
Shingles .... number..	3,000,000	15,000	20,000
Other produce	....	500	30,000
Lumber, timber, etc	....	50,000	225,000
Total	....	100,375	838,000
INWARD FREIGHTS.			
General merchandise	....	14,000	585,000
Grand total	....	114,375	1,423,000

The commerce has been carried on by two steamers of 100 tons and 20 tons, respectively, and a number of pole boats, rafts, etc.

As will be seen from Messrs. F. Rhem & Sons statement, the freights have increased by about 9,710 tons over last year, but the value has decreased.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 7.

IMPROVEMENT OF SANTEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For description of river see p. 916, Annual Report for 1880. For new project see p. 1184, Annual Report for 1889. For map of river see p. 1186, Annual Report for 1889.

ORIGINAL CONDITION.

This river was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide. Four steamers and a few small vessels were then running upon portions of the river.

PLAN OF IMPROVEMENT.

The project of 1880 proposed to provide the river with a good outlet through Mosquito Creek to Winyah Bay by deepening and straightening this creek to 50 feet width and 7 feet depth; to secure 7-foot navigation in the river from its mouth 120 miles to Wright Bluff, and thence 5-foot navigation 23 miles farther to the head in the Congaree and Wateree rivers.

The revised project of 1889 provides for leaving the Mosquito Creek Canal, which has been completed 30 feet wide and 3 feet deep, for a timber route; cutting a new canal between Estherville and Minim Creek large enough for river steamers, and snagging the entire river, at an estimated cost of $350,000.

WORK PRIOR TO JUNE 30, 1893.

A passage 30 feet wide and 3 feet deep at high water through Mosquito Creek to Winyah Bay had been made. The river had been snagged between points 41 and 42 miles above the mouth, 285 obstructions having been removed. Dredging on the new cut between Estherville and Minim Creek had begun. The total excavation on both canals up to June 30, 1892, amounted to 221,460 cubic yards measured in situ, and had been done by contract, except 1,169 cubic yards. Dividing the total expenditures to June 30, 1892, for all purposes by the above number of cubic yards excavated, shows the average cost of dredging here by contract to have been 51 cents per cubic yard measured in place. Between June 30, 1892, and September 30, 1892, 26,694 cubic yards were dredged by a hired dredge and United States employés at a cost of about 24 cents a yard measured in place. Dredging was then stopped and work on a new dredge owned by the United States was begun. At the close of June, 1893, this dredge was nearly ready for work. It was a powerful dredge of the Osgood pattern, with main engines 12 inches in diameter and 18-inch stroke.

WORK OF PAST YEAR.

Delay in receiving some parts of the machinery of the new dredge prevented beginning work before the 21st of November. She worked continuously till April 30, 1894, at which date she was laid up, as the funds were getting low and the locality was very sickly.

In the five months she was at work she made the following record:

	Quantity.	Stumps.	Total cost.	Cost per cubic yard.	Length in feet cut 50 feet wide and 7 feet deep at low water.
1893.	*Cu. yds.*			*Cents.*	
November 21 to 30	5, 572	7	$512	7	575
December	15, 721	220	690	4	1, 325
1894.					
January	13, 628	268	456	3	1, 235
February	12, 000	53	945	8	565
March	29, 996	138	470	2	1, 650
April	14, 313	107	265	2	725
Total	91, 230	793	3, 348	3. 7	6, 075

This includes all expenses for supervision, labor, fuel, repairs, supplies, and duplicate parts. Nothing is added for depreciation of plant. The cost is one-tenth that of doing the same work at the lowest price bid under the last advertisement for a contract, and the United States has done in five months more work with its own machine for less than $4,000 than has ever before been done on this improvement by contract for $30,000 in any two years. An advance of over a mile has been made 50 feet wide and 7 feet deep at low water. The machine is now on hand in first-class order, and if funds are provided in time the cut will be completed 50 feet wide all the way through to Santee River in the coming year, and a large amount of work will be done toward widening the first cut to the full projected width. The first cut is wide and deep enough to allow steamers to use it as soon as it reaches the Santee River. The material has been very hard and includes in places a network of large and solid cypress stumps, buried out of sight in the layer of pipe clay which forms the main constituent of the excavated prism.

For details of work done and commercial statistics reference is made to the appended report of my assistant engineer, Mr. Reid Whitford, to whom is due the greatest credit for the phenomenally cheap and good piece of dredging which has been done on this work in the five months from December, 1893, to April, 1894, inclusive. His careful attention prevented accident to the plant and kept expenditures down to the lowest point consistent with first-class work.

REMARKS.

No new line of transportation has been established on this river during the year.

The balance of $1,734.38 on hand July 1, 1894, will be held for care of plant till new funds become available, when what remains will be combined with the new funds and the whole applied to dredging and possibly some snagging in the river itself.

During the year the freight passing over this stream has aggregated 115,428 tons.

This river is in the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$22,000.00
Passed August 3, 1882	20,000.00
Approved July 15, 1884	15,000.00
Approved August 5, 1886	18,750.00
Of August 11, 1888	24,000.00
Approved September 19, 1890	30,000.00
Approved July 13, 1892	30,000.00
Total	159,750.00
Total expenditures, including June 30, 1894	158,015.62

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$16,040.37
June 30, 1894, amount expended during fiscal year	14,305.99
July 1, 1894, balance unexpended	1,734.38
July 1, 1894, outstanding liabilities	431.46
July 1, 1894, balance available	1,302.92
Amount (estimated) required for completion of existing project	290,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Santee River, South Carolina, for fiscal year ending June 30, 1894:

The dredge reconstructed by the United States began work at station 15 (stations 100 feet apart, 0 being at Winyah Bay end), on Estherville Minim Creek Canal, November 21, 1893, and ceased operations April 28, 1894, at station 78+75, on account of exhaustion of the appropriation. The cut, 50 feet wide and 6 to 8 feet deep at low water, penetrated the land a distance of 6,075 linear feet. There were removed 91,230 cubic yards of material, 3 logs, and 793 stumps, at a cost of 3½ cents per cubic yard (including stumps and logs). In addition, 4,258 cubic yards of material have been built into embankment on the Georgetown road through Estherville plantation, by William H. Johnstone, at a cost of 20 cents per cubic yard. Average cost of embankment work and United States dredge work combined equals 4 cents per cubic yard.

REMARKS.

As will be seen from the above cost of excavation, the dredge owned and operated by the United States has been a great success, and has done its work with decided advantage and economy to the Government. The dredge is of dipper pattern, with Osgood machinery, its capacity being from 1,000 to 2,500 cubic yards per day, according to the character of material being excavated. The marsh land through which the canal passes consists of a little mud, very many solid cypress stumps, and a great deal of tenacious pipe clay, which is not only difficult to dig, but exceedingly troublesome to dump.

The Mosquito Creek Canal passage has continued to be almost indispensable to the public in trading between Santee River and Georgetown. No new line of transportation has been established on this river during the past year.

RECOMMENDATIONS.

It is respectfully recommended that the Mosquito Creek route be maintained and that dredging on Estherville Minim route be continued with dredge owned by the United States and hired labor, and that a good channel, with at least 80 feet width and 4 feet depth at dead low water, be provided and maintained in the Santee River proper, so as to permit steamers to run uninterruptedly throughout the whole year.

COMMERCE.

The accompanying letter and statement of commerce was furnished by Mr. Louis S. Ehrich, president of the Georgetown Board of Trade, one of the most prominent and enterprising citizens of Georgetown, and probably the largest shipper of freights in the community. He has given the statement for this river his personal attention for the past several years, and he is doubtless in a position, being engaged in large cross-tie and lumber business on Santee River, to know more about the commerce than any one in this place.

Steamers of from 60 to 300 tons have run with their usual regularity from landings on Santee to Charleston and to Georgetown via Mosquito Creek Canal. Large quantities of cypress timber have come through Mosquito Creek Canal during the year.

GEORGETOWN, S. C., *May 17, 1894.*

DEAR SIR: In compliance with your request I beg to submit herewith a report of the statistics of Santee River, and desire to say that the falling off in some of the items was entirely due to the gales of last August and October, as the acreage planted in rice and cotton was the largest since the war and up to the time of the gales gave promise of an abundant harvest. The falling off in imports is also due to the same cause, as the planters and farmers did not have the means to buy in many cases the necessities of life after the heavy losses sustained.

The timber interests show a steady increase, and will, for many years to come, more especially when the new Government cut through Minim Creek is completed.

Very respectfully,

LOUIS S. EHRICH.

REID WHITFORD, ESQ.,
U. S. Assistant Engineer.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD.						
Cotton .... bales..	20,000	5,000	$850,000	22,000	5,500	$800,000
Rosin .... barrels.	140,000	24,500	175,000	150,000	30,000	185,000
Spirits of turpentine .... do....	25,000	4,687	350,000	26,000	5,100	355,000
Timber .... pieces..	12,000	18,000	60,000	21,000	25,200	90,000
Shingles	3,000,000	1,500	15,000	3,500,000	1,750	17,500
Lumber .... feet..	2,000,000	3,333	20,000	2,000,000	2,000	20,000
Railroad ties	23,000	1,610	6,900	35,000	2,800	10,500
Wool .... pounds..	50,000	25	15,000	50,000	25	12,500
Hides .... do....	15,000	8	1,500	20,000	10	1,600
Seed oats .... bushels..	7,000	210	4,200	8,000	184	4,800
Rice .... do....	100,000	2,200	150,000	140,000	3,220	175,000
Staves	500,000	500	2,500	400,000	1,000	2,200
Wood .... cords..	10,000	10,000	12,000	12,000	12,000	15,000
Game and fish	....	15	1,500	....	34	1,700
Total	....	71,588	1,663,600	....	83,823	1,690,800
INWARD.						
Fertilizers	....	*7,500	225,000	....	4,600	230,000
Groceries, provisions, etc	....	*11,667	350,000	....	6,600	330,000
Dry goods	....	*4,000	225,000	....	4,500	225,000
Boots, shoes, etc	....	*4,000	200,000	....	4,000	200,000
Hardware, implements, machinery...	....	*1,500	80,000	....	2,000	100,000
Grand total	....	100,255	2,743,600	....	110,523	2,775,800

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD.						
Cotton .... bales..	22,000	5,500	$700,000	15,000	4,200	$575,000
Rosin .... barrels..	161,000	35,000	191,000	135,000	27,000	164,000
Spirits of turpentine .... do....	26,450	5,200	361,000	23,000	4,700	318,000
Timber .... pieces..	23,000	39,400	131,000	28,000	32,400	143,000
Shingles	....	....	....	4,000,000	2,000	20,000
Lumber .... feet..	....	....	....	2,500,000	2,500	25,000
Railroad ties	46,000	3,500	13,800	62,000	4,400	18,600
Wool .... pounds..	50,000	25	12,500	50,000	25	12,500
Hides .... do...	20,000	10	12,000	25,000	13	2,000
Seed oats .... bushels..	10,000	302	6,000	11,000	256	4,950
Rice .... do....	....	....	....	80,000	1,600	48,000
Rice, rough .... do....	125,000	30,000	150,000	....	....	....
Staves	500,000	500	2,500	400,000	1,000	2,200
Wood .... cords..	10,000	10,000	12,500	15,000	15,000	15,000
Game and fish	....	45	2,300	....	34	1,750
Total	....	102,482	1,594,600	....	95,128	1,350,000
INWARD.						
General merchandise	....	21,700	1,085,000	....	....	....
Fertilizers	....	....	....	....	4,800	250,000
Groceries, provisions, etc	....	....	....	....	6,000	300,000
Dry goods	....	....	....	....	4,000	200,000
Boots, shoes, etc	....	....	....	....	3,500	175,000
Hardware, implements, etc	....	....	....	....	2,000	100,000
Grand total	....	124,182	2,679,600	....	115,428	2,375,000

* Value of these tons is necessarily estimated.

EMPLOYÉS.

Mr. J. D. Mayo, master machinist, a first-class marine engineer, and a thorough manager of machinery, deserves much credit for the economical and satisfactory manner in which he has served the U. S. Government for the past year. He has worked the dredge's machinery with entire satisfaction to this office. Mr. J. D. Mayo has been very efficiently and cheerfully assisted on the dredge work by Mr. J. C. Tamplet.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 8.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 914, Annual Report for 1880. For map of river see p. 1190, Annual Report for 1889.

ORIGINAL CONDITION.

In 1882 this stream had a low-water depth of from 3 to 4 feet from its mouth 67 miles to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without drawspans; thence to Camden navigation was possible, but dangerous, except during high water. Its commerce was practically nothing.

PLAN OF IMPROVEMENT.

The project provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

WORK PRIOR TO JUNE 30, 1893.

The river had been snagged between points 67 miles and no miles above the mouth; since 1884, 18,175 obstructions having been removed. Previous to June 30, 1884, the records are not sufficiently detailed to give exact figures, but a very considerable amount of work had been done on the river. The railroad bridges had been provided with draws. Dividing the total expenditures, $36,619.15, for all purposes between June 30, 1884, and June 30, 1893, by the above number of obstructions removed shows the average cost during that period to have been $2.02 for each obstruction. A good steam snag boat had been built, and is now on hand in first-class condition in every respect.

WORK OF PAST YEAR.

Very little work could be done with the small sum on hand, so the snag boat was only run over the river a few times to take out the snags that gave the steamers the most trouble, and the rest of the year was operated on other rivers, her expenses being charged to the streams she worked on. For details of work done and commercial statistics reference is made to the appended report of my assistant engineer, Mr. Reid Whitford, who has shown marked ability in directing and controlling the working parties and maintaining the efficiency of the plant.

REMARKS.

No new line of transportation has been established on the river during the year. The appropriation of September 19, 1890, completed the amount that this improvement was estimated to cost. By the expenditure of this sum the entire portion of the river covered by the project has been put into good condition for steamboat navigation. For its maintenance the snag boat owned by the river should be kept at work continuously. The stream is well worth this expense, which would amount to about $6,500 a year. If appropriations were made every two years, $13,000 could be advantageously spent in that period.

To keep this important river open for its increasing commerce the sum asked for is absolutely essential for maintenance.

The balance of $570.26 on hand July 1, 1894, will be applied to care of United States plant till new funds are provided by Congress.

During the year the freight passing over this stream has aggregated 18,075 tons.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$8,000.00
Passed August 2, 1882	15,000.00
Approved July 5, 1884	5,000.00
Approved August 5, 1886	7,500.00
Of August 11, 1888	12,000.00
Approved September 19, 1890	12,500.00
Approved July 13, 1892	2,500.00
Total	62,500.00
Total expenditures, including June 30, 1894	61,929.74

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$3,045.66
June 30, 1894, amount expended during fiscal year	2,475.40
July 1, 1894, balance unexpended	570.26
July 1, 1894, outstanding liabilities	85.00
July 1, 1894, balance available	485.26
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	6,500.00

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Wateree River, South Carolina, for fiscal year ending June 30, 1894:

The United States steam hoister and hired labor continued work so as to maintain the previously cleared channel over the entire river under improvement from the mouth to town of Camden. There were removed from the channel 47 logs, 22 stumps, 43 large snags, 3 cords small snags. The total amount was expended on the channel. Each obstruction cost, approximately, $1.71.

REMARKS.

The progress of the work was delayed by high water. Many new obstructions were found to have made their appearance in the channel during stoppage of work for the sickly season. It will require at least $6,000 per year to maintain a good, permanently navigable channel over this river. The current carries large quantities of drift coming down from above Camden, which lodge along the banks, forming new obstructions. The erosion of some of the banks cause also obstructive trees to fall in the way of passing steamers. The stream should be kept free of these or it would soon become impassable except at high stages of the water.

RECOMMENDATIONS.

It is respectfully recommended that a good navigable channel be provided and maintained, so that steamers may be permitted to run uninterruptedly throughout the whole year.

COMMERCE.

The following statement was obtained by Mr. E. C. Easterling, timekeeper, from captains of steamers running on the river and shippers along its banks:

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ..... bales	415	104	$20,750	617	154	$21,600
Cotton-seed oil ..... barrels	270	54	3,780	395	91	4,345
Cotton-seed meal	....	27½	605	135	135	2,700
Cotton-seed hulls	....	10	25	....	15	45
Cotton seed ..... bushels	1,000	15	300	....	200	2,200
Resin ..... barrels	1,000	175	1,250	3,500	700	7.000
Rough rice ..... bushels	10,000	220	12,500	7,000	161	8,750
Total	....	....	39,210	....	....	46,640
INWARD FREIGHTS.						
General merchandise	....	400	12,000	....	788	39.400
Grand total	....	1,005½	51,210	....	2,244	86,040

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ..... bales	570	143	$20,950	500	125	$15,000
Staves ..... number	....	....	....	5,000	10	300
Resin ..... barrels	18,000	3,600	36,000	1,400	196	1,540
Cotton-seed oil ..... do	470	112	8,190	378	91	4,725
Rice, rough ..... bushels	10,000	230	10,000	500	10	500
Cypress logs ..... number	....	....	....	8,000	16,000	40,000
Fertilizers	....	....	....	....	200	4.940
Oak staves ..... number	7.000	17	42	....	....	....
Hay ..... tons	12	12	216	....	....	....
bales	....	....	....	....	6	84
Cotton seed ..... tons	483	483	10,626	....	....	....
Linters	30	8	600	27	7	270
Cotton-seed hulls ..... tons	20	20	60	....	25	75
Total	....	4,625	86,684	....	16,730	67,434
INWARD FREIGHTS.						
General merchandise and supplies	....	1,617	31,045	....	1,345	26,900
Grand total	....	6,242	117,729	....	18.075	94,334

This statement shows an increase over last year of 11,833 tons. The commerce has been carried on by one steamer of about 200 tons, and numerous rafts.

EMPLOYÉS.

Capt. Kilbia Morse, overseer, Mr. E. C. Easterling, timekeeper, have been, as usual, very faithful and efficient in discharge of their respective duties.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

M 9.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see p. 1140, Annual Report for 1885. For map of river, see p. 1194, Annual Report for 1889.

ORIGINAL CONDITION.

In 1886 this stream had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia; thence 1 foot low-water depth 2 miles farther to its head. Navigation of the lower 47 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

PLAN OF IMPROVEMENT.

The project proposes to secure a thoroughly cleared 4-foot navigation over the lower 47 miles at all stages of water, and a cleared channel 100 feet wide through the shoals above, at an estimated cost of $54,500.

WORK PRIOR TO JUNE 30, 1893.

The river had been snagged between points no miles and 47 miles above the mouth, 5,014 obstructions having been removed. The railroad bridge had been provided with a draw.

Dividing the expenditures to June 30, 1893, for all purposes by the above number of obstructions removed, shows the average cost to have been $4.03 for each obstruction.

A good steam snag boat had been built and is now on hand. It needs a new hull, but the machinery is in fine order. The average cost of work on this river has been abnormally high, as it is comparatively free from small snags, was so broad that but little bank work was necessary, and what work was done was very heavy and was much scattered, necessitating great loss of time while the boat was moving from one snag to the next. This river is also liable to frequent, sudden floods of short duration, which entirely stop work for three or four days at a time, but not long enough to make it advisable to lay up the boat and discharge the hands.

WORK OF PAST YEAR.

The river was quite thoroughly worked over between points no miles and 29 miles above the mouth. Each obstruction removed cost about $1.08. On December 15 a resolution of the House of Representatives was made calling for a report and estimate for improving the 2 miles of the river at Columbia, to the same depth as the rest of the river. The report submitted is appended to this report.

REMARKS.

No new line of transportation has been established on the river during the year. The balance of $498.25 on hand July 1, 1894, will be applied to care of United States plant till new funds are provided by Congress.

During the year the freight passing over this stream has aggregated 7,974 tons.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year of 1893, $7.23.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved August 5, 1886	$7,500.00
Of August 11, 1888	7,500.00
Approved September 19, 1890	5,000.00
Approved July 13, 1892	5,000.00
Total	25,000.00
Total expenditures, including June 30, 1894	24,501.75

For table of commercial statistics furnished by the collector of Georgetown, S. C., see this year's annual report for Waccamaw River.

Money statement.

July 1, 1893, balance unexpended	$3,007.74
June 30, 1894, amount expended during fiscal year	2,509.49
July 1, 1894, balance unexpended	498.25
July 1, 1894, outstanding liabilities	127.20
July 1, 1894, balance available	371.05
Amount (estimated) required for completion of existing project	29,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1894.

CAPTAIN: I have the honor to report as follows on Congaree River, South Carolina, for fiscal year ending June 30, 1894:

Work of snagging and clearing banks began January 11, 1894, by United States steam hoister and hired labor, clearing the channel from mouth of river to 29 miles to an approximate width of 80 feet and depth of 4 feet at low water. From the channel 251 logs, 57 stumps, 125 large snags, and 20 cords small snags were removed. From the banks 313 trees cut. Of the total amount expended, six-tenths were used on the channel and four-tenths were used on the banks. Each obstruction cost, approximately, $1.08. This river yet requires a large amount of work to provide a

thoroughly cleared channel over its entire length. When once completed it will, like its neighboring river, the Wateree, need snagging yearly to maintain the improvement. Drift coming down during freshets and trees falling in from erosion of the banks will cause the channel to again become obstructed.

RECOMMENDATIONS.

It is respectfully recommended that a good navigable channel be provided and maintained to at least 80 feet width and 4 feet depth at dead low water, so as to permit steamers to run uninterruptedly throughout the whole year from mouth of river to Gervais street bridge at the city of Columbia.

COMMERCE.

The following statement was obtained from the best source of information available:

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ..... bales..	100	25	$5,000	150	38	$5,250
Spirits of turpentine ..... barrels..	218	41	4,360	303	30	7,575
Rosin ..... do....	8,200	1,435	11,480	10,975	2,743	16,450
Hay ..... bales..	....	....	....	....	....	....
Cotton seed ..... tons..	....	....	....	....	275	2,750
Total	....	1,501	20,840	....	3,086	32,025
INWARD FREIGHTS.						
General merchandise	....	900	27,000	....	600	30,000
Grand total	....	2,401	47,840	....	3,686	62,025

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ..... bales..	225	56	$7,875	....	....	....
Spirits of turpentine ..... barrels..	250	50	3,750	200	50	$3,500
Rosin ..... do....	6,500	1,300	13,000	1,600	224	1,760
Hay ..... bales..	500	75	1,500	....	....	....
Cotton seed ..... tons..	500	500	5,000	....	....	....
Timber ..... sticks..	....	....	....	3,000	6,000	18,000
Granite ..... cubic yards..	....	....	....	1,200	1,500	7,500
Total	....	1,981	31,125	....	7,774	30,760
INWARD FREIGHTS.						
General merchandise	....	800	40,000	....	200	10,000
Grand total	....	2,781	71,125	....	7,974	40,760

The above shows an increase of 5,193 tons, but a decrease of value. This was probably owing to the class of freights transported over the river. On account of the irregular trips of steamers on this stream shippers could not economically hold products and supplies demanding quicker movement to await the uncertain arrivals and departures of steamboats, and consequently such freights sought outlets to and from markets by rail and overland wagon routes. The commerce has been carried on by occasional trips of one steamer of 200 tons, timber rafts, etc.

EMPLOYÉS.

I wish to express my thanks to Mr. William Alden James, clerk, who deserves special mention for his untiring efforts in assisting me to carry out your orders relative to this and all other river and harbor works connected with this office.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

LETTER FROM THE SECRETARY OF WAR, TRANSMITTING, PURSUANT TO HOUSE RESOLUTION DATED DECEMBER 15, 1893, INFORMATION RELATING TO THE NECESSITY OF DEEPENING THE TWO MILES OF THE CONGAREE RIVER BELOW COLUMBIA, S. C.*

WAR DEPARTMENT,
Washington, D. C., January 6, 1894.

SIR: In response to a resolution of the House of Representatives, dated December 15, 1893, requesting information regarding the necessity of further deepening the 2 miles of the Congaree River just below Columbia, S. C., than is provided for in the approved project for that river, and the cost of securing such, I have the honor to transmit herewith a letter from the Chief of Engineers, dated January 4, 1894, submitting a copy of a report, dated January 2, 1894, from Capt. F. V. Abbot, Corps of Engineers, on the subject. The estimated cost of constructing a movable lock and dam at this locality is $250,000.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 4, 1894.

SIR: I have the honor to acknowledge receipt of the resolution dated December 15, 1893, of the House of Representatives of the United States, requesting the Secretary of War "to furnish the House of Representatives at the earliest day practicable such information as he may have regarding the necessity for providing deeper draft over the 2 miles of the Congaree River just below Columbia, S. C., than is contemplated in the present approved project for that river, and that he be requested further, to submit a plan and estimate of the cost of securing a depth in this 2 miles of river equal to that already provided for the rest of the stream."

The resolution is herewith returned, and in reply to its reference to this office I have the honor to submit the accompanying copy of report of the 2d instant on the subject from Capt. F. V. Abbot, Corps of Engineers, the officer in charge of the Congaree River. Captain Abbot estimates the cost of constructing lock and movable dam at this locality to be $250,000.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

HON. D. S. LAMONT,
Secretary of War.

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* Printed in House Ex. Doc. No. 66, Fifty-third Congress, second session.

REPORT OF CAPT. F. V. ABBOT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., January 2, 1894.

GENERAL: I have the honor to submit the following report, giving the information called for by the following resolution of the House of Representatives:

> *Resolved,* That the Secretary of War be, and is hereby, requested to furnish the House of Representatives at the earliest day practicable such information as he may have regarding the necessity for providing deeper draft over the 2 miles of the Congaree River just below Columbia, S. C., than is contemplated in the present approved project for that river, and that he be requested further to submit a plan and estimate of the cost of securing a depth in this 2 miles equal to that already provided for the rest of the stream.

Both the old project and the resolution make the Gervais street bridge the extreme upper limit of navigation.

The approved project provides for "a thoroughly cleared channel of 100 feet width and 4 feet depth at low water below Granby, and of a natural depth above Granby." Granby is at the lower end of the 2 miles covered by the resolution. The words "natural depth" mean the depth that would be found over the solid-rock bottom of this part of the river if it were cleared of the bowlders that now prevent all navigation, even when the general depth would admit it. The extreme low-water discharge of the Congaree River is such that the depth in the channel clear of bowlders would not exceed 15 inches at several points, as the river at that stage would plunge over three natural rock dams. The cleared channel could not be made straight, and until the river reached the stage about 5 feet above low water the velocity due to excessive slope would be so great that no steamboat would dare to attempt to follow it. The slope of natural water surface at low stages is made up of a succession of pools and rapids. The total fall from Gervais street bridge to Granby, the head of navigation at the present time, varies with the stage of river as follows:

Stage at Gervais street.	Fall of water surface in 2 miles discussed.	Average slope per mile.	Maximum slope per mile.
	Feet.	*Feet.*	*Feet.*
1 foot above low water	8	4	12
5 feet above low water	4	2	2

A rise of 4 feet at the Gervais street bridge means a rise of 8 feet at Granby. At the 5-foot stage steamers could go up the river to Gervais street if the loose bowlders were removed from the channel. The river is usually below this stage for a great part of the season most useful to commerce.

To have a line of steamers on this river pay their owners a fair return on the money invested they must run regularly and at all stages. If they reach Columbia, the board of trade of that city guarantee them 250,000 to 300,000 tons of freight per annum. (See appended letter of the president, Mr. W. J. Murray.) This would keep the boats busy, and they would get besides a large amount of freight from farmers and turpentine operators, who do not use the present irregular steamers which run on the Congaree for a while and then are changed without warning to some other river.

In a second letter Mr. Murray states that a regular line of steamers running twice a week is promised them if the river can be made available to Gervais street.

The second question involved in the necessity for bringing the boats to Columbia is, could not the freights be carried from Columbia to Granby much more cheaply than the river could be improved. Transportation by wagons has been tried, and is much too costly. A short railway might be built, but there is great uncertainty about the right of way, as one of the railroads entering Columbia has now certain rights which it will not surrender. Such a road would have great difficulty in reaching the factories and other heavy shippers, and the expense of double handling of the heavy freights which would naturally seek water transportation appears to make the success of such a venture too doubtful for private capital to engage in. The parties who are proposing to run the steamers refuse to put on their boats if they have to depend on such a railroad connection. They are afraid it might be purchased by the competing railroads.

When steamers reach the Gervais Street bridge they are at the lower end of a high level canal 100 feet wide and 10 feet deep, which extends for three miles along Columbia's water front. This canal has been built to develop a very large water power, and one large mill is already up and others are contracted for. Their shipments, with anything sent from the 3 miles served by the canal, could easily be delivered to the steamers in the river below. At this point also the tracks of eight railroads are close to the river.

For the amount of commerce involved, reference is made to the appended letter from the Columbia Board of Trade. Their figures were very carefully collected last summer, and show a total commerce of about 950,000 tons, valued at over $10,000,000.

The board of trade are willing to guarantee between 200,000 and 300,000 tons of freight per annum to the steamers which would connect at Georgetown with the Clyde steamers for Wilmington and New York, and at Charleston with Clyde steamers for the North and South, and with tramp steamers for Europe.

SUMMARY.

1. The approved project will give steamers access to Columbia only at irregular intervals.
2. It does not pay to run a good line of steamers on this river unless they can reach Gervais street.
3. A line of steamers is promised if the river between Gervais street and Granby is improved for all stages.
4. A sufficient trade appears to await such a line of steamers if run regularly.
5. A trade of $10,000,000 is affected, as all freight rates would be lowered by the competition between railroads and steamers.
6. The improvement gives Columbia direct water connection with the North, South, and abroad.

Project and estimate.—An accurate survey has been made of the bed of the river and of the banks up to extreme high-water mark. The bed is mostly rock ledge, covered with large bowlders, and in a few places with sand. Ledges extend entirely across the river in three places in the 2 miles, forming natural dams, which begin to affect the surface slope as soon as the river gets below the 5-foot stage. If a channel large enough for steamers was cut through them the pools above would be lowered, and no gain in depth would be secured till the surface slope was reduced to a small fraction of a foot, as the low-water discharge is but small. To do this would involve excavating over a mile in length and to a depth in places of over 8 feet in solid granite. The cost is prohibitory.

The only practicable way to improve this 2 miles of river is to build a lock and dam, and thus raise the water level just enough to enable steamers to pass over the ledges at extreme low water. A dam and lock near Granby which would raise the low-water level 8 feet would effect this result. There is an admirable site for this purpose, where there is solid rock all the way across for a foundation at such a depth that a dam only about 15 feet high above the foundation is needed.

A fixed dam at this point would overflow a considerable quantity of land in time of extreme freshet, and might lay the United States open to suits for damages. It would also permanently raise the water level in the river above it as far up as Gervais street at all stages. The canal already built for power purposes now terminates at Gervais street, but the owners propose to extend it as far as Granby eventually. The fixed dam would thus diminish the power head to be derived from the canal extension. If a movable dam be built, the low-water levels will be the only ones affected, as the dam will be lowered as soon as the river rises. The difference in cost is not enough to make it advisable to use a fixed dam. To obtain the most complete and reliable data for a movable dam at this point the Great Kanawha River, West Virginia, was visited, and some of the dams in that stream were found to compare closely with that proposed for the Congaree. The estimate of cost is based on the actual figures for which the Kanawha locks and dams have been completed, allowing for differences in length of lock required and height of dam. The lock is estimated as 55 feet wide in the chamber and 150 feet between quoins. This will admit steamers of the size best adapted for navigating the river. The lift will be 8 feet. The movable dam estimated for is of the wicket pattern, so successfully used on the Kanawha, the width of the navigable pass being 150 feet.

ESTIMATE.

	Quantity.	Price.	Total.
LOCK.			
Logs in cofferdam ....linear feet..	40,000	$0.30	$12,000
Sheathing ....feet, B. M..	20,000	30.00	600
Excavation ....cubic yards..	4,000	2.00	8,000
Embankment ....do....	10,000	.60	6,000
Puddling ....do....	300	1.50	450
Concrete ....do....	500	8.00	4,000
Backing masonry ....do....	5,000	6.00	30,000
Rock-face masonry ....do....	1,500	10.00	15,000
Pointed-face masonry ....do....	1,000	15.00	15,000
Cut-stone masonry ....do....	300	17.00	5,100
Sills ....do....	220	18.00	3,960
Quoins ....do....	100	20.00	2,000
Coping ....do....	200	20.00	4,000
Stone filling ....do....	3,000	2.00	6,000
Riprap, hand-placed ....do....	2,000	2.00	4,000
Paving ....do....	1,200	5.00	6,000
Timber in permanent construction ....feet, B. M..	150,000	40.00	6,000
Anchor bolts ....pounds..	5,000	.06	300
Bolt holes in masonry ....feet..	1,000	.30	300
Total			128,710
MOVABLE DAM.			
Cofferdam logs ....linear feet..	60,000	0.20	12,000
Sheathing for cofferdam ....feet, B. M..	40,000	30.00	1,200
Cofferdam filling ....cubic yards..	10,000	.60	6,000
Excavation ....do....	7,500	2.00	15,000
Embankment ....do....	1,500	.60	900
Puddling ....do....	1,000	1.50	1,500
Concrete ....do....	1,000	8.00	8,000

ESTIMATE—continued.

	Quantity.	Price.	Total.
MOVABE DAM—continued.			
Masonry, rock-face .... cubic yards..	1,800	$10.00	$18,000
Masonry, pointed-face .... do....	400	15.00	6,000
Masonry, cut-stone .... do....	100	17.00	1,700
Masonry sills .... do....	250	18.00	4,500
Masonry, coping .... do....	350	17.00	5,950
Stone filling .... do....	1,000	1.25	1,250
Riprap, hand-placed .... do....	700	2.00	1,400
Bolt holes in masonry .... feet..	5,000	.30	1,500
Timber in permanent construction .... feet, B. M..	100,000	40.00	4,000
Land, site, buildings	....	....	15,790
Diving apparatus	....	....	1,300
Fixed ironwork	....	....	4,000
Movable ironwork	....	....	10,000
Woodwork, wickets	....	....	1,300
Total for movable dam	....	....	121,290
Total for lock	....	....	128,710
Grand total	....	....	250,000

No maps are submitted herewith, as they would have to be on a large scale to show anything, and would be very bulky.

Respectfully submitted.

FREDERIC V. ABBOT,
Captain of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Wm. P. Craighill, Corps of Engineers, Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., January 2, 1894.

Respectfully submitted to the Chief of Engineers.

I have had the opportunity to confer with Capt. Abbot in considerable detail as to the subject of this report, which has been called for by the House of Representatives. I concur in his views.

WM. P. CRAIGHILL,
Colonel, Corps of Engineers.

LETTERS OF PRESIDENT OF COLUMBIA BOARD OF TRADE.

COLUMBIA BOARD OF TRADE,
Columbia, S. C., August 9, 1893.

DEAR SIR: The commercial interest of our city is rapidly on the increase in volume of tonnage, and we feel deeply the need of water navigation which will give us lower freight rates and place us on a parity with other points. We fully realize that this end can only be obtained and give us the needed relief by opening up Congaree River for navigation to Gervais street.

In this city our large mill is about completed, and others will at once follow that could load right from the mills into the boats, being at such a convenient point. To utilize these boats (the present terminus of the head of navigation, Granby, does not or ever can give us the needed relief we ask and need) the river must be opened up to Gervais street. We are promised by a large and wealthy New York syndicate that they will put boats on the river to move our freights just as soon as the river is made navigable to Gervais street. We could guarantee to give these boats, if they could come up to Gervais street, from 250,000 to 300,000 tons of freight per annum for the first year, which will increase rapidly from year to year, as they will be liberally patronized by the merchants and shippers of freights, especially by heavy freight, of which this city handles a large tonnage.

The discrimination against Columbia in freight rates is very much against her progress and prosperity of her commercial interest. With the relief we ask, the completion of deep water to Gervais street, we feel that we would double our commercial interest within the next few years; we know of several manufacturing interests that have been deterred from locating here because of the high rate of freights, notwithstanding we have eight different lines of railroads centering in this city. You will find below a tabulated statement of the commerce of this city for the year ending May 31, 1893. This data is correct so far as I have been able to get it. I would state that the most of this tonnage is the receipts obtained from the merchants. I found it impossible to get what was shipped out, as the railroad agents do not keep a record of the yearly tonnage of this place.

COMMERCIAL STATISTICS OF COLUMBIA, S. C.

Articles.	Tons.	Value.
Cotton (60, 000 bales)	15, 000	$2, 400, 000
Rosin (53, 000 barrels)	10, 600	74, 000
Turpentine (27, 600 barrels)	6, 875	550, 000
Cotton-seed oil	6, 000	123, 000
Kerosene oil (80,000 barrels)	20, 000	440, 000
Cotton seed	60, 000	600, 000
Phosphate rock	20, 000	100, 000
Cotton-seed meal	24, 000	528, 000
Cotton-seed hulls	30, 000	90, 000
Fertilizer	20, 000	400, 000
Rock	175, 000	175, 000
Brick	28, 000	112, 000
Lime and cement (9,000 barrels)	2, 250	20, 000
Coal	20, 000	160, 000
Wood (fuel)	30, 000	100, 000
Lumber (35,000,000 feet)	70, 000	175, 000
Hardware, machinery, etc	100, 000	875, 000
Hay	4, 000	72, 000
Grain	150, 000	440, 000
Cattle (3,680 head)	1, 280	92, 000
Hogs (5,000 head)	500	35, 000
Sheep (2,000 head)	100	5, 000
Boots and shoes	3, 500	400, 000
General merchandise (not included)	200, 000	2, 500, 000
Total	997, 105	10, 466, 000

Yours, truly,

W. J. MURRAY,
President.

Capt. F. V. ABBOT,
U. S. Engineer.

COLUMBIA BOARD OF TRADE,
Columbia, S. C., August 11, 1893.

DEAR SIR: We have been advised by parties who would be glad to put boats on the river (Congaree River) when it is made navigable up to Gervais street, but that they will not do so to connect with any railroad that might be built to connect at Granby with boats. This project would not meet with the approval or patronage of the merchants or shippers of heavy freights, such as the boats would expect to haul. They have found out that the plan to connect with railroads at Granby would not pay them. They are satisfied, after giving the matter thorough investigation, that they would not get the freights to haul, and we hope that no such plan of connecting at Granby with railroads will be entertained, as it will never give the commercial interest at large the needed relief.

Yours, truly,

W. J. MURRAY,
President.

Capt. F. V. ABBOT,
U. S. Engineer.

M 10.

IMPROVEMENT OF HARBOR AT CHARLESTON, INCLUDING SULLIVAN ISLAND AND MOUNT PLEASANT SHORE, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For history of operations up to June 30, 1888, see p. 970 Annual Report for 1888. For modified project, including estimates, see p. 1150, Annual Report for 1889.

ORIGINAL CONDITION.

There were four channels across the bar, the deepest having about 12 feet at low water.

PLAN OF IMPROVEMENT.

It is proposed to establish and maintain, by means of two jetties, a low-water channel of not less than 21 feet across the bar. The action of the jetties is to be assisted by dredging. The estimated cost of the project is $4,380,500, if the jetties are left at mean low-water level throughout. If brought up to 3 feet above mean low-water level throughout, $5,334,500.

WORK PRIOR TO JUNE 30, 1893.

The foundations of both jetties had been completed of the crest of the bar, and the shore end of the South Jetty had been strengthened and extended well up on Morris Island. Log mattresses loaded with stone were used throughout as foundation, and to some extent as hearting. About 6,000 feet of the North and about 9,000 feet of the South Jetty had been raised to or above high-water mark. Considerable dredging had been done.

The following material had been used and dredging performed:

	Dredging.	Stone.	Stone.	Mattress.
	Cu. yds.	*Tons.*	*Cu. yds.*	*Sq. yds.*
North Jetty		187, 994	122, 335	175, 155
South Jetty		217, 586	143, 414	306, 585
Total	616, 192	405, 580	265, 749	481, 740

The United States owned a good quarry plant, a good stone-handling plant, and a first-class pump dredge.

Engineering methods employed.—From the beginning all materials have been handled from floating plant. The mattresses were simply strongly-tied log rafts, with a layer of brush on top to hold the stone from slipping while sinking. They were supported between two lighters, towed to place, accurately put in position by hauling on anchor lines with capstans on the lighters, were then partially loaded with stone, and dropped in place by letting go the lines holding them to the scows. (See appended photograph.) This operation required comparatively calm weather, but on good days enough mattresses could be set and partially loaded to keep the stone plant almost always busy completing their loading till another good day for mattress work. As long as the jetties were below low-water level "one man" stone was used, and this was deposited by placing the lighters in position and rolling the stone overboard by hand. After the work reached the level of low water, steam derrick scows were used, and the stone was slung and swung out into position over the jetty and dropped in place by some tripping arrangement. The most convenient and certain method of tripping has proved to be a sling chain with a hook at the end and a stout ring in a link about 18 inches from the hook. A strong trip line is hooked into this ring, and passes over a sheave at the outer end of the derrick boom, and down along the boom to a cleat. When the stone has been raised, the trip line is hauled taut by the attendant and made fast to the cleat. The boom is swinging in the mean time. As soon as the stone is over its desired place, the hoisting drum friction clutch is released, and the weight of the stone thus transferred from the falls to the trip line. This being fast to the ring causes the sling chain to slip through the hook, releasing and dropping the stone very certainly and with much less jerk to the machinery than would be anticipated. Stones weighing 6 and 7 tons are dropped in this way without difficulty or danger. Several styles of derrick scows have been employed. Photographs of the two most successful types are appended to this report.

The dredging has been done entirely by pumping. The dredge is owned by the United States and is described in the assistant engineer's report on Charleston Harbor, for 1891, p. 1472, Report Chief of Engineers, U. S. Army, for that year. Photographs are appended showing the general appearance of the vessel and some important details.

WORK OF PAST YEAR.

The engineering methods described above have been used by the contractors during the year, but the results, both in amount of work done and in depth attained in the channel, are greater than have been secured before. This has been due to the continuing contract feature, which has enabled the contractors to keep on working after funds for their payment had become exhausted. At the close of the year they have earned nearly $300,000 more than they have been paid for, and the completion of stonework is only a matter of comparatively few months. The general scope of this continuing contract was fully discussed in the Annual Report for 1893, pp. 1496 to 1499, and has proved very satisfactory. The Government plant has been kept in good order by the contractors, repairs having been made by them without question whenever they were notified to do so, and no friction or trouble has occurred during the year, due to their use of plant rented from the United States. The contractors, Messrs. Egan & Friday, deserve much credit for this, as well as for their energy in hastening work and their ability and desire to comply fully with the specifications in all respects.

During the year the work has been very varied in character, and for details reference should be made to the report of Mr. James P. Allen, assistant engineer, who in addition to his usual fieldwork has made numerous and extended surveys, and has assisted most efficiently both in field and office.

As the jetties near completion it becomes most important to gather facts regarding a new tidal condition both inside and outside of the harbor, and two self-registering tide gauges have been started, and a third is nearly ready. The outer one is only about 2,000 feet inside of the outer end of the North Jetty, and is in such a very rough locality that it has been supplied with a clock which winds itself electrically every hour. With a roll of paper which will run a month, it is hoped that this arrangement will make it possible to obtain a continuous record of the tide at this very important station, which would be out of the question with an ordinary clock requiring winding once a week. This gauge was only started in June, 1894, and at the close of the year had not been in operation long enough to safely report any definite conclusions regarding it. To develop the local relationship of tidal slope and velocity a line of levels was thrown out along the jetties to this tide gauge, connecting it with that at Fort Sumter, and to the third which is in the inner harbor close to Castle Pinckney. Much valuable and necessary information will be given by these comparative gauge readings referred to the same level plane.

A careful study of the tide-gauge records at Fort Sumter for the years 1883, 1884, 1890, and 1892 appears to show that the level of mean high water has not been materially affected by the jetties, while the mean low-water level is not quite so low as formerly. The difference developed is, however, so slight, and there is such a doubt thrown on the level of the bench mark by the earthquake of 1886, that perhaps the only safe generalization is that the range of tide has decreased between 0.3 and 0.4 of a foot in the nine years from 1883 to 1892. The records for 1893 were too incomplete for discussion, as the storm of August 27 carried away the gauge and wharf at Fort Sumter, and it was not possible to get a new gauge started and running properly for a long time, as the almost universal destruction of wharf property in the city prevented my getting anyone to rebuild the structures which had been carried away.

STORM OF AUGUST 27–28, 1893.

By 1 o'clock Sunday, August 27, the storm had begun to develop, and by 3 p. m. had assumed serious intensity. The following table shows the barometer readings and wind velocities, as measured and officially reported by the Weather Bureau:

SUNDAY, P. M.

Time.		Barometer reading.	Wind, velocity, and direction.
h.	*m.*	*Inches.*	
4	54	29.521	
5	25	29.504	
5	45	29.482	
6	10	29.464	
6	35	29.405	66 miles an hour from northeast.
6	40	29.396	
6	45	....	Back to north.
6	50	29.377	
7	00	29.372	
7	10	29.347	
7	20	29.337	
7	26	....	Backed from north to west.
7	30	29.332	
7	47	....	Backed from west to south 72 miles per hour.
7	51	....	Backed from south to east.
8	00	29.330	
8	10	....	East 84 miles per hour.
8	50	29.325	East 72 miles per hour.
9	00	29.322	Rainfall so far 2.20 inches.
9	10	....	East 72 miles per hour.
9	15	29.308	
9	25	29.291	
9	45	29.277	
11	40	29.153	East 88 miles per hour.
12	00	29.140	Do.

MONDAY, AUGUST 28, A. M.

12 10	29.134	70 miles per hour.
12 20	29.123	88 miles per hour.
12 30	....	Extreme velocity for one minute up to this time has been 97 miles per hour.
12 45	29.099	
12 32	....	96 miles per hour.
12 36	....	Extreme wind velocity so far for one minute, 126 miles per hour.
1 15	29.078	
1 50	29.076	
1 59	29.078	Barometer rising for first time.
2 10	29.080	
2 30	....	88 miles per hour from southeast.

Velocities given above are for five minutes' travel. After 4 p. m. Sunday the wind at no time fell below 40 miles per hour till after 10 a. m. of the 28th, and for the rest of that day it still blew hard.

A number of reliable water marks at Fort Sumter, on Sullivan Island, and in the city were secured and show that the tide which accompanied this hurricane (about 11½ feet above mean low water) was the highest of which there is any authentic record at this place, although uncertain tradition reports one in 1752 as being 10 feet above high water. In the city the wharf front was very badly broken up, many of the wharves having nothing left in place but the piles. Many houses lost their roof covering, and all cisterns near either water front were filled with salt water. Many of those nearer the middle of the town were polluted with salt water carried to the roofs by the force of the wind. Much damage was done houses located near the water by the battering of their lower walls by timbers dashed against them by the waves. Throughout the city streets were blockaded by fallen trees, and in the lower parts by great masses of driftwood. Several brick buildings were completely blown down. The stone parapet of the sea wall along the east battery water front was thrown down for long distances. The Engineer Office lost its roof, and entire window sashes were blown in. Much damage from wind and water resulted. Shipping was badly injured, a number of vessels being destroyed at the wharves and others drifted far ashore. A number of abandoned and water-logged ships were subsequently towed into port. No reliable estimate of the money damage can be made. On Sullivan Island the damage was, of course, greater than in the city. A number of houses were completely wrecked and swept away by the water. The loss of life in the city and on Sullivan Island was about 10, mostly negroes. On Sullivan Island a large number of people were saved only by taking refuge in Fort Moultrie. The contractors for Charleston Harbor had 23 lighters loaded with rock, most of which were moored in Sullivan Island Cove. Most of them dumped their loads in whole or in part, and many were drifted far up into the marshes. Only one was destroyed entirely. The contractor's two tugboats and all of the Government plant were saved. The dredge resumed work two days after the storm, using salt water in her boiler, as all the fresh-water hydrants on the wharves were lost.

At Fort Sumter the light-house keeper's house outside the gorge wall was utterly destroyed, even the débris being washed away. The inspector's house inside the fort was undermined, and partly tipped over, but not otherwise injured. The most serious damage was to the earthwork of the southeast face, about 7,000 cubic yards of this parapet being entirely washed away down to or below the level of the scarp wall. Two guns mounted behind this parapet were undermined and fell forward, turning a complete somersault so that they now lie upside down, chassis wheels in the air, the wooden platforms on top of the chassis, and the guns themselves out of sight in the sand. The lighthouse keeper and his family, with the ordnance sergeant and his wife, were saved by spending the night in one of the magazines.

The tremendous energy of the waves which accompanied this storm gave the jetties as severe a test as could well be asked for, and it was an immense relief to see them standing safely and unhurt when the weather cleared again. Where the north jetty had been reinforced with stone, the top had been knocked off and distributed on the slopes, making the structure about 50 feet wide at low-water level, with a very smooth upper surface rising along the axis slightly above high-water mark. (See appended photograph.) The south jetty, which was not so high and had received no extra stone, was comparatively little changed. A survey was made as soon as the Government naptha launch, which was high and dry on shore and cut off from the water by a large schooner, could be gotten afloat. No marked changes were found in the jetty channel, which was somewhat but not greatly deeper than it had been found in the preceding June.

SURVEYS.

The area between the jetties has been surveyed every three months during the year, and each survey has shown a better channel than its predecessors. The annual survey was made in May, 1894, and shows a good, practicable 17-foot channel at low water all the way through from deep water outside the bar to the city wharves. A number of vessels drawing over 20 feet have come in during the last few months without touching, and one drawing 20 feet 10 inches went out safely and reported depth to spare.

Considering the area between the parallel parts of the jetties and for about 1,500 yards seaward and 1,800 yards landward (limited laterally by the straight lines of the jetties prolonged), the following changes deserve attention. During the year 1,079,000 cubic yards of material have disappeared. Of this 479,000 have been removed by the dredge and 600,000 by the scouring action of the jetties. The above gain in waterway (or decrease of obstructing material) during the past year equals the whole amount that was gained from 1884 to 1893. This is unquestionably due to the rapid work done during the past eighteen months. To examine these results more in detail, divide the above area into three equal bands or zones 300 yards wide and parallel to the outer parts of the jetties. The year's scour is as follows:

	Cubic yards.
In the zone nearest the north jetty	304,000
In the middle zone	330,000
In the zone next the south jetty	445,000

An important feature is that the zone of greatest cut is not the middle one (that in which the dredge worked), but the southern zone, and that in this zone the cutting has in no place been dangerously near the jetty itself, but well off from it.

Along the axis of the dredge cut there is a length of about 1½ miles which now has the full projected depth of 21 feet or more at mean low water. A gain of 1 mile has thus been made in the past twelve months.

Except in the area above discussed there has been very little change, with the exception that to the south of the south jetty there is a plain indication of the lodgment of the material which has been scoured out from the area between the jetties. This confirms what has been reported before, that as a rule material eroded from the jetty channel tends to move off to the southwest out of the way of commercial routes.

The channel leading about eastward from the black buoy passed t outer end of the north jetty, noted in previous reports during the ye continues to improve, and is now occasionally used by smaller steame and sailing vessels.

The increase of depth over the whole area between the jetties h been so general that this year the sheet of comparative surve appended to this report has been shaded to show the changes in t 18-foot and 9-foot curves, while heretofore the changes discussed we those of the 15 and 9 foot curves.

There is every reason to anticipate that the full depth contemplat in the project will be attained with less expenditure than the amou of the estimate, and that the cost of maintenance will be small.

MISCELLANEOUS.

About half of the shore protection at Mount Pleasant was destroy in the August hurricane; the remainder has stood well and has acco plished its purpose. The bridge across the cove in rear of Sulliv Island was partly finished and then abandoned, leaving a very b obstruction to navigation. Active steps to have this removed, und provisions of fourth and fifth sections of the river and harbor a approved September 19, 1890, have been inaugurated.

REMARKS.

Payments for stone under the continuing contract were stopped January 1, 1894, as the balance from the appropriation of March 1893, was then rapidly approaching the $187,500 which by law cou not be paid before July 1, 1894. The contractors at that time laid part of the United States stone plant and continued to rent t balance. This rent will be deducted from the payment that will made the contractors on July 2, 1894. Payments for dredging we continued throughout the year, and the rent of the Government dred was deducted each month from the payment made the contracto

This work is in the collection district of Charleston, S. C., which is the port entry. Amount of duties collected in the calendar year of 1893, $16,689.75.

APPROPRIATIONS.

As the work is so nearly completed it seems most desirable th Congress should supply funds, so that the contractors can wind their affairs at the time they have to stop work. For this purpose t full $750,000 asked for in my last annual report should be supplied once, and $400,000 more will suffice to complete and maintain the wo till June, 1896.

The apparent balance on hand July 1, 1894, $237,265.36, will not sufficient for work done and not paid for during the fiscal year endi June 30, 1894.

Since the existing project of improvement has been adopted the f lowing appropriations have been made:

By act of Congress—	
Approved June 18, 1878.	$200,000.00
Approved March 3, 1879.	200,000.00
Approved June 14, 1880.	170,000.00
Approved March 3, 1881.	175,000.00
Passed August 2, 1882..	300,000.00
Approved July 5, 1884.	250,000.00
Approved August 5, 1886	187,500.00
Of August 11, 1888....	350,000.00

By act of Congress—	
Approved Sept. 19, 1890.	$870,000.
Approved July 13, 1892.	225,000.
Approved Mar. 3, 1893.	750,000.
Total	3,177,500.
Total expenditures to June 30, 1894	*2,940,234.

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*Includes the cost of building shore protections on Sullivan Island and Mo Pleasant shore.

Money statement.

uly 1, 1893, balance unexpended		$631, 285.33
une 30, 1894, amount expended during fiscal year		394, 019.97
uly 1, 1894, balance unexpended		237, 265.36
uly 1, 1894, outstanding liabilities	$370, 600.00	
uly 1, 1894, amount covered by uncompleted contracts	1, 126, 461.26	
		1, 497, 061.26
mount appropriated by sundry civil act of August 18, 1894		450, 000.00
Amount (estimated) required for completion of existing project		753, 000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		753, 000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

The following drawings and papers accompany this report:

heet 1. Map showing survey of 1894, profiles of the jetties, and profile showing comparative soundings on axis of dredged cut in 1889 and 1894.
heet 2. Comparison of surveys of 1884, 1893, and 1894. Table of commercial statistics furnished by the collector of the port.
tatistical letter of Mr. Edward Willis.
Photographs:
o. 1. Sinking mattresses at outer end of north jetty. View taken from extreme outer end of high stone pile.
o. 2. North jetty as left by hurricane of August 27, 1893. View taken from top of outer tide gauge house.
o. 3. Two double-derrick steam hoisters at work on outer end of south jetty.
o. 4. United States single-derrick steam hoister; capacity, 15 tons; boom 60 feet long. View taken at Union Wharf.
o. 5. General view of U. S. dredge *Charleston* at the dock.
o. 6. Deck view on U. S. dredge, showing middle bin and south jetty in the distance.
o. 7. Character of discharge in middle bin, U. S. dredge *Charleston*. An equal stream is simultaneously discharged into the forward bin.
o. 8. Drag used on U. S. dredge *Charleston*. Inventor Capt. E. O. Patterson. Extreme capacity actually realized, 9¼ yards of sand per minute.

REPORT OF MR. JAMES P. ALLEN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., June 30, 1894.

CAPTAIN: I have the honor to report for Charleston Harbor, South Carolina, as ollows:

Stonework, north jetty.—The widening of the inner portion of the north jetty with tone in sizes from 10 pounds to 500 pounds was continued, working between points ,266 feet from shore end and 5,673 feet from shore end. The same force of hands ontinued raising this jetty to low water, working from 5,340 to 5,620 feet from hore. Three thousand and fifteen tons of stone were used here, completing the idening from 2,009 to 5,760 feet from shore, as described in the last annual report, nd also the raising of the central portion of the jetty to low water, from 5,340 feet o 5,760 feet from shore. The raising of the inner portion of this jetty with stone nder 2 tons in weight, as described in the last annual report, was completed with the se of a single lighter load of stone of 178 tons distributed between 5,660 feet and ,900 feet from shore end. The reenforcing of the outer portion was completed, orking from 11,550 feet to 14,235 feet from shore, using 38,449 tons of stone. The attress extension of this jetty was begun June 11, 1894. Eight mattresses have een placed, and 7,761 tons of stone used. In dimensions of mattresses, distribuion of stone, and mode of doing work this extension is precisely like the south jetty xtension, which will be described later.

Stonework, south jetty.—The raising of the shore end was completed as far as intended, the work being done between 605 feet and 700 feet from shore. Eight hundred and sixty-five tons were used. The raising of this jetty to high water and above was continued, work being done between 14,575 feet and 16,440 feet from shore end. At the end of the last fiscal year this work was being done by two hoisters approaching each other. Toward the end of August there remained a gap of only about 120 feet that was not raised. The storm of August 27, 1893, brought down the high part to about ordinary high water, and from 14,800 to 16,440 feet it was again raised. Thirty thousand seven hundred and eighty-two tons of stone were used. On July 10, 1893, the first mattress was set in extension of the foundation of the south jetty, and the last was placed February 5, 1894. Forty-two mattresses were used in this work, extending the jetty from 16,440 to 18,787 feet from shore end. With the inward extension this jetty is now 19,104 feet long. The mattresses were each about 100 feet across the jetty and 50 feet in its length. They were not placed in juxtaposition, but spaces were left between them. The average space is about 6 feet. This was done because it was thought best to avoid laps. In this situation the lapped portion is liable to break off. The number of square yards of mattress used was 23,285. The mattress work was covered with small and medium-sized stone to the thickness of about 3 feet. The small stone was also carried over the edges of the mattresses for 10 feet on each side, so that this jetty extension is practically 120 feet wide. Medium-sized stone, called locally "bar rock," because it is unloaded by men with crowbars, was placed along the center line and brought up to low water with a top width of about 20 feet. In some portions of the work it is above low water. The total number of tons of stone used here, both small and medium, was 59,736 tons. The small stone was generally in sizes from 10 to 250 pounds, and the "bar rock" from 250 pounds to 1 ton. After the completion of this small-stone work on the mattresses in March, 1894, work was begun upon the widening of the inner 7,000 feet. This began at 5,017 feet and was carried inward to 3,508 feet. It is all on the north side of the jetty, extending from 20 feet north to 80 feet north of the center line, and is made as nearly as possible 3 feet thick with stone between 10 and 500 pounds. For this 14,922 tons were used. This work was discontinued temporarily when the work of extending the north jetty with mattresses was begun in June, 1894, inasmuch as all small stone will be needed for this extension. In bad weather, however, the contractors may put off small stone if they so elect at this less-exposed place. The extension of the south jetty has been brought up to about 16 feet above low water in the usual ridge with steep side slopes from 16,440 feet to about 18,710, except a gap of 290 feet between 17,530 and 17,820. The number of tons used at this place was 58,524, the stone being between 1 ton and 7 tons in weight. A few stone went in that were over 7 tons in weight. Total stone and mattress during year: 49,403 tons of stone were placed on the north jetty; 164,829 tons of stone were placed on the south jetty; 4,479 square yards of mattress were placed on north the jetty; 23,285 square yards of mattress were placed on south jetty.

So far as it was possible to do so without prejudice to the work, the sizes of the stone were so arranged as to take the quarry run, the sorting into the different classes being done at the quarry.

Stone plant.—The contractors, Egan & Friday, used the same stone plant as last year during the early part of the fiscal year, but after January 1, 1894, they laid up and discontinued the use of the two United States hoisters, two derricks on Union Wharf, and the United States quarry near Edgefield. They were allowed to do this, as no funds were available for stonework. Again on June 1 they resumed work in the United States quarry. The largest month's work was 26,648 tons of stone in June, and was done with two hoisters and two gangs working by hand.

Dredging.—The U. S. dredge *Charleston* has worked continuously with the exception of such lay up as was necessary for repairs and preservation. She has removed 503,055 cubic yards. The dumping has been done during the year at what are known as "inner dump" and "outer dump." The inner dump is just south of south jetty in the old Main Ship Channel. For the outer dump the dredge runs about south from the outer end of the cut and begins dumping nearly on the range of the cupola of the rice mill, foot of Laurens street, Charleston, and the northeast corner of Fort Sumter. She continues dumping thence to the southward near the edge of the bar.

Storms.—On August 27-28, 1893, there occurred one of the severest hurricanes which has ever visited this coast. The wind attained a velocity for a short time of over 120 miles. The tide rose to nearly 11¼ feet above mean low water. The storm lasted with but little abatement for twenty-four hours. This storm caused a considerable disorganization of the contractor's plant. Several lighters were carried ashore and upon the marshes, some of them being loaded with stone. Two lighters were sunk in the dock, and several dumped their loads at Sullivan Island. One hoister was left upon the track of the East Shore Terminal, and one lighter was destroyed. In spite of this backset, however, work was resumed on September 5. Again on October 13 there was a severe storm, and more lighters dumped their loads in Sullivan Island Cove. The rock so dumped interfered with the use of the cove as a harbor, l most of it was taken up by the contractors at considerable expense. The Gov- ment plant sustained no loss.

Accidents.—Until this year there have been no casualities upon the work, but now must record the death of two laborers. One was knocked overboard by a cap- n bar on the extension of the south jetty and drowned, and one was struck by the aking of a derrick. On December 1, 1893, the tug *Britannia* struck the bottom ır the outer end of the south jetty and sank, about 1,500 feet slightly east of th from Swash Channel buoy No. 8, in about 22 feet of water. She was raised by contractors, repaired, and is now in use upon the jetty work.

Repairs.—The United States plant has been kept in fair condition by the contract- , who have made with reasonable promptness such repairs as you have required.

Surveys.—In July and August, 1893, a survey was made of the eastern wharf front the city of Charleston, with soundings; also a survey of the western end of Hog and Channel. In the fall and winter months an effort was made to connect the er ends of the jetties and all of the principal points in the harbor by levels. The in object of this work was, in connection with the three self-registering tide ıges, to study the slopes and tidal phenomena of the harbor. It was necessary in s leveling to make a number of long crossings of the water spaces. The longest of se was about 7,500 feet. They were made by securing equal back and fore sights, h across water spaces and not across land and water, in order to get equal refrac- n as nearly as possible. A closed polygon was made for the inner and another the outer harbor. The inner polygon had a perimeter of about 10 miles, and levels failed to close by 0.03 foot. The outer polygon was about 11 miles around 1 the levels failed to close by 0.13 foot. A Brandis engineer's level was used. e levels of precision as ordinarily made were considered too sensitive to tremors be used in these exposed positions. Self-reading rods were prepared for the pur- se. The observations were made by two observers, one reading the rod and the ıer watching the bubble. Both rods were in position at once, so that the back- ht and foresight were taken in quick succession. A number of observations re made at each setting, the observers exchanging duty. A few cross sections of inner portions of the jetties were made in March and April, 1894. Some of the ore line of the inner harbor was surveyed in March and April to complete a large et of the inner and outer harbors on a scale of 1 inch to 500 feet. Surveys of the a between the jetties have been made in September, December, and March. The ty force have also made surveys for military defenses on Sullivan Island and a sur- of the sea face of Fort Sumter after the gales. The annual survey was made in y, 1894. It covers the areas between and beyond the outer portions of the jet- s, and about one-half mile to the north and south. Parts of the beaches of Mor- and Sullivan islands were also surveyed. Sketched profiles of the jetties were de in May and June. The usual two sheets have been prepared for your annual ort; No. 1 a chart with profiles of the jetties and dredge cut, and No. 2 a com- ison of surveys between 1884, 1893, and 1894.

Tide gauges.—The old tide gauge at Fort Sumter, which had been in use since 2, was carried away in the storm of August 27. It was proposed before this rm to erect two more tide gauges, one near Sullivan Island and the other near outer end of the north jetty. After the storm authority was obtained and a v tide-gauge house erected near Fort Sumter. The U. S. Coast and Geodetic vey supplied a gauge for this, the understanding being that they should have records or a copy. This gauge was started January 27, 1894, and has been rking since. It was some time before a good record was obtained, but it is now rking fairly well.

he outer tide gauge is 7,496 feet south and 16,952 feet east of the station on Fort nter. It is about 130 feet from the center line of the jetty inside and about 2,200 t from its seaward end. The house was completed in June, 1894, and the gauge rted on June 9. This gauge has an electric self-winding clock, and it is hoped t it will run without attention for a month. It was decided recently by you t the third gauge would give more valuable information if erected nearer the y, and it is now being built near Castle Pinckney in the inner harbor.

Deep Pocket.—There is no change worthy of note at this place.

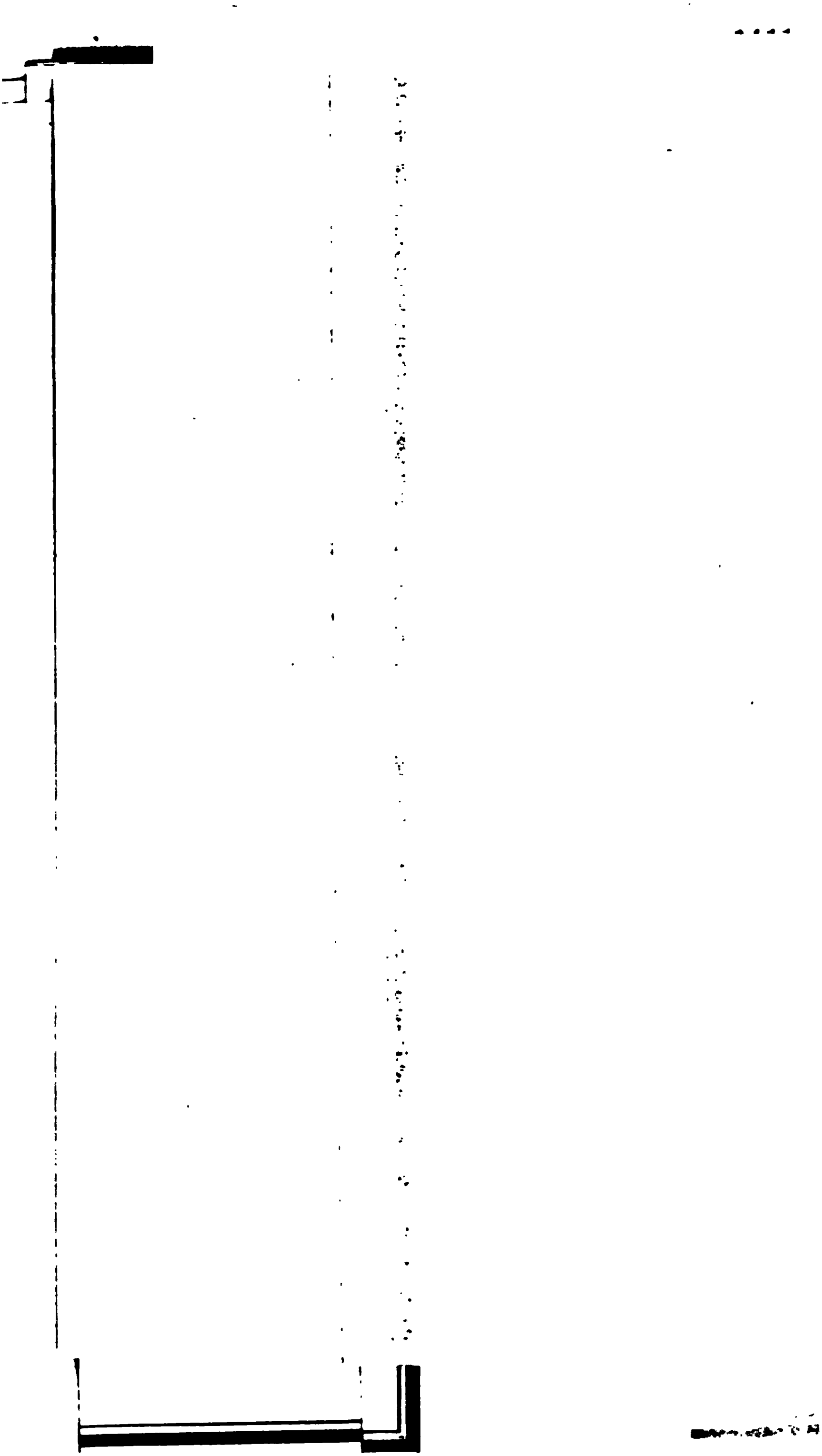
Mean soundings.—Following the same system as in the report of 1893, and com- ing 1894 with 1893, we have: In Zone No. 1 the six inner squares show a scour of 254 cubic yards. The five squares along the north jetty show a scour of 169,776 ic yards and the outer five squares show a scour of 83,285 cubic yards. The al scour on this zone is 304,315 cubic yards. On Zone No. 2, inner six squares 424 cubic yards scour, middle five squares 294,705 cubic yards scour, and the er five squares 12,814 cubic yards scour. Total scour on this zone 329,943 cubic ds. In Zone No. 3 the six inner squares 198,604 cubic yards scour, the middle squares 102,505 cubic yards scour, and the outer five squares 144,148 cubic yards ur. Total scour on this zone 444,257 cubic yards. The total scour on this area ce last year is 1,079,515 cubic yards. Considering all squares, eight on the outer l, one in the middle, and three on the inner portion show fill. The remaining rty-six show scour.

Curves and depths in the jetty channel.—Last year we were able to report a 15-foot channel between the jetties. This year there is certainly 17 feet and only at two points, for a very short distance, is there a break in the 18-foot channel. Generally the channel has ample width. The outer 18-foot curve has moved seaward, except to the north of the north jetty, where it has withdrawn perceptibly. The maximum advance is about 800 feet. The inner 18-foot curve has not changed greatly, except that the channel along the dredge cut is wider. The seaward movement of the outer 15 and 12 foot curves is even greater. There are few changes in the inner curves, and none that seem worthy of note. Some lumps in the middle portion of the area surveyed, defined by the 12-foot curve, can be identified with similar lumps on the map of 1893 with a slight seaward progression. On the outer shoal and north of the dredge cut the areas of both the 12-foot and 9-foot curves are greatly reduced, being about half the size of those shown on the map of 1893. South of the dredge cut there is but little water shallower than 12 feet. On the survey of December, 1893, there was not a single sounding of less than 12 feet on this part of the outer shoal. The shoal along the south jetty on the channel side has changed in shape and position somewhat, but has about the same area. On the map of 1893 another channel was indicated in process of formation from the dredge cut in an easterly direction and passing out beyond the end of the north jetty. This has constantly increased in depth and width. It shows now an available depth of nearly 15 feet. Just at the end of the jetty it is narrow, and the work now being done at this point will either close it or shove it further seaward. The area covered by the survey to the north of the north jetty has changed but little, except in the 18-foot curve as already noted. The area south of the south jetty has not changed over the inner portion. Opposite the present end of the south jetty the curves have advanced rapidly seaward near the jetty, but starting a few hundred feet southwest from the jetty end to the limit of the survey of 1893, they have moved shoreward in the case of the 12-foot curve to a marked extent.

Condition of the jetties.—As will be seen by the profile, a very marked lowering of the crest of the higher portions of the jetties is shown for long stretches. This was due to the storms, mainly to that of August 27–28. The outer parts, where it is now shown 12 feet high above mean low water, have been built up since the storms. After the August storm the crest of the high portion of the north jetty was from 5 to 7 feet above low water, while the south jetty was from 3 to 5 feet above low water. This jetty, as will be seen by last year's profile, was lower before the storm than the other, less stone having been put on and more time having intervened since it was built up. There is really but little change in the south jetty profile from 7,000 feet to 14,000 feet. While the crests of both jetties were lowered, the stone has assumed a much more stable form and is more compacted. The August storm can be fairly said to have done the jetties good rather than harm. The October storm made but little change, except upon the work done after the August storm. The cross sections do not indicate any settlement of the inner low portions. The north jetty sections show deepening on both sides of the jetty. This jetty has been widened with stone to reenforce it against overpour. The south jetty sections indicate increased depth on both sides in the main ship channel and for 2,000 feet west of it, but more markedly so on the south side. From 3,000 feet to 1,500 feet from the shore end there is but little change on the south and a slight deepening on the north side of the jetty. From 1,500 feet to shore there is no change on the south, but a very marked deepening on the north side. This jetty is partially widened. More work will be done to provide against settlement from overpour before the completion of the present contract.

Sullivan Island.—Near the inner end of the north jetty both the high-water and low-water lines have moved landward. About 800 feet west of the jetty this movement amounts to 150 feet in the high-water and 100 feet in the low-water line. At 1,500 feet west of the jetty the low-water line crosses that of last year, and at 2,000 feet west the high-water line crosses, showing to the west of these points a maximum advance seaward in the said low-water line of about 100 feet, while the high-water line has advanced only about 50 feet. Near the Bowman Jetty there is a slight landward movement to the east and advance seaward to the west of the jetty. The change near the north jetty is undoubtedly due to the storms of 1893, this part of the beach having less protection from the jetties. The practical persistence of that part of the beach near the Bowman Jetty and 3,000 feet east of it, in following the general law of change shown for some years past, indicates to my mind its protection in storms by the high portions of the jetties. It was very marked to residents of Sullivan Island that waves along this portion of the beach during the gales, were not nearly so high as in previous storms. The destruction to property on this island was considerable, but would have been greater but for the protection afforded by the jetties.

Morris Island.—The high and low water line on the front have both moved landward to the north of the jetty; near the jetty about 150 feet. At the head, they have moved south about 200 feet. South of the jetty the high water has advanced



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UNIV. OF MICH.

ward slightly for about 1,000 feet of the beach, and for the remaining part it has ved slightly landward, while the low-water line has advanced for the whole length the beach surveyed. There is thus shown but little change south of the jetty. change to the north is noteworthy, especially as for the past two years the shing away of the head of this island has appeared to be checked. This may e been done by the storm of August, 1893.

Iount Pleasant Shoal.—No work was done. The jetties built in 1884 are in fair ndition. The breakwater built in 1892 was partially destroyed by the gale of gust, 1893. About one-half of it remains in good shape.

Vrecks.—The wreck of the *Kate V. Aitken* was not entirely removed, but was cut vn so as to be no longer dangerous to navigation. Her position being so near the er shoal, no vessels go near the wreck at present. On October 10, 1893, the tug *W. Morse* was wrecked by striking the outer bar while attempting to enter the mpkin Hill Channel. She was seen by the captain of the dredge *Charleston* flying gnal of distress, and was towed by him to a point inside of the jetties where she k. She lies about one mile southeast of Fort Sumter. Her masts are still stand- and show above water. When these fall, as they probably will before next nter, this wreck may become a dangerous obstruction to navigation.

Employés.—The same force as was reported last year has been employed during s year. Mr. De Saussure having been relieved from weighing at Columbia by the t that the contractors stopped getting stone from that point in December, 1893, s brought to Charleston, where he has assisted on surveys and in the office. It is h regret that I am obliged to note the death of Col. F. L. Childs, inspector of dredg- , which occurred June 10, 1894. Col. Childs has from time to time been connected h the jetties since the initiation of the work, and has inspected all of the dredg- that has been done. He was a conscientious, faithful, and interested inspector, l had the respect of his associates. Mr. J. B. De Saussure is now inspecting the dging. All of the gentlemen associated with me have done excellent and com- ndable service during the year.

Very respectfully, your obedient servant,

JAMES P. ALLEN,
Assistant Engineer.

apt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

ivals and clearances of vessels and commerce at Charleston, S. C., from January 1, 1875, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
....	504	382,018	11,949	38	13,144	326	198	88,879	2,404	740	484,041	14,379
....	471	340,439	10,113	44	11,898	335	224	101,272	2,768	739	453,009	13,216
....	400	324,919	9,885	32	13,972	308	336	105,480	2,851	668*	444,371	13,044
....	398	322,527	9,623	44	19,935	455	329	163,368	3,967	772	505,830	14,045
....	383	326,681	10,027	39	12,505	319	240	121,503	3,292	668	460,659	13,638
....	441	388,026	20,641	38	12,412	327	191	110,771	2,595	670	511,209	13,563
....	412	399,732	10,377	34	9,430	272	257	121,077	3,073	703	530,239	13,722
....	410	384,690	9,446	35	4,807	224	200	105,647	2,648	645	495,144	12,318
....	345	277,538	7,629	26	3,002	157	239	113,768	2,958	610	394,308	10,744
....	425	304,382	9,822	21	3,910	145	214	134,076	3,269	690	442,368	13,236
....	375	268,477	9,637	15	2,344	97	187	106,233	2,586	577	377,054	12,320
....	901	550,209	....	20	3,714	131	182	114,507	2,646	1,103	668,403	....
....	927	656,949	....	30	7,074	199	127	67,257	1,607	1,084	731,280	....
....	*924	601,771	....	34	7,750	252	127	72,921	1,779	1,085	682,442	....
....	†339	481,718	9,708	30	6,985	216	136	87,101	1,979	496	575,804	11,903
....	‡410	600,776	13,677	35	7,205	242	120	81,518	1,828	565	689,499	15,745
....	§417	680,776	15,695	27	4,665	179	150	119,199	2,383	594	804,640	18,257
....	‖388	625,880	14,705	28	5,138	193	87	69,091	1,416	503	700,109	16,314
....	¶338	566,923	13,106	28	6,622	202	108	92,532	1,970	474	666,077	15,278

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* Of these, 32 vessels (tonnage, 31,035), with crews numbering 608, were foreign.

† Of these, 29 vessels (tonnage, 9,440), with crews numbering 546, were foreign.

‡ Of these, 58 vessels (tonnage, 55,533), with crews numbering 1,110, were foreign.

§ Of these, 34 vessels (tonnage, 39,078), with crews numbering 717, were foreign.

‖ Of these, 31 vessels (tonnage 30,949), with crews numbering 562, were foreign.

¶ Of these, 31 vessels (tonnage, 36,156), with crews 633, were foreign.

Arrivals and clearances of vessels and commerce at Charleston, S. C., from Janu 1875, to December 31, 1893—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.	
				American vessels.			Foreign vessels.				
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.
1875	461	328, 266	10, 830	57	24, 679	555	211	94, 595	2, 527	729	447, 540
1876	431	278, 744	9, 095	60	23, 598	546	230	103, 276	2, 812	721	405, 618
1877	335	234, 429	7, 719	35	22, 767	423	250	108, 446	2, 910	620	365, 662
1878	266	172, 988	5, 801	45	24, 397	479	398	149, 975	3, 591	509	347, 360
1879	287	188, 212	6, 268	34	11, 282	292	278	149, 052	3, 643	599	348, 546
1880	296	190, 733	6, 348	45	23, 210	481	246	155, 768	3, 375	587	369, 711
1881	268	187, 569	5, 942	32	9, 239	255	278	153, 796	3, 464	578	350, 604
1882	147	113, 699	3, 690	40	7, 375	273	263	158, 250	3, 584	450	379, 324
1883	98	48, 714	2, 018	27	4, 560	181	299	154, 653	3, 815	424	207, 927
1884	212	116, 020	4, 555	31	7, 845	217	276	161, 588	3, 727	519	285, 453
1885	191	99, 658	5, 047	24	5, 217	164	204	119, 602	2, 836	419	224, 467
1886	890	543, 259	....	25	5, 469	165	201	126, 943	2, 875	1, 116	675, 671
1887	888	610, 646	....	28	5, 837	189	173	115, 218	2, 546	1, 089	731, 701
1888	*911	580, 468	....	30	5, 848	211	144	96, 146	2, 105	1, 085	682, 462
1889	†46	358, 596	778	25	5, 080	174	165	112, 037	2, 495	236	155, 713
1890	‡21	12, 863	292	41	10, 161	318	166	126, 078	2, 676	228	149, 102
1891	§29	21, 197	436	32	6, 887	216	164	143, 398	2, 809	255	171, 482
1892	‖26	29, 752	565	28	5, 760	197	111	89, 390	1, 798	165	124, 902
1893	¶49	47, 756	978	29	5, 761	198	100	88, 421	1, 671	178	141, 938

* Of these, 7 vessels (tonnage, 4,295), with crews numbering 62, were foreign.

† Of these, 4 vessels (tonnage 2,960), with crews numbering 47, were foreign.

‡ Of these, 7 vessels (tonnage, 6,186), with crews numbering 135, were foreign.

§ Of these, 18 vessels (tonnage, 16,332), with crews numbering 303, were foreign.

‖ Of these, 13 vessels (tonnage, 15,068), with crews numbering 261, were foreign.

¶ Of these, 29 vessels (tonnage, 31,810), with crews numbering 554, were foreign.

COMMERCE.

Year.	Value of exports.	Value of imports.
1875	$19, 655, 966	$680, 343
1876	18, 088, 152	455, 562
1877	16, 917, 492	161, 237
1878	21, 167, 575	184, 127
1879	18, 693, 126	127, 981
1880	24, 939, 259	248, 158
1881	21, 927, 269	723, 049
1882	19, 907, 099	459, 970
1883	20, 144, 365	467, 648
1884	20, 833, 424	503, 504
1885	15, 157, 889	588, 191
1886	17, 410, 000	635, 000
1887	15, 288, 316	484, 063
1888	13, 006, 578	625, 770
1889	16, 080, 255	664, 696
1890	15, 204, 771	836, 628
1891	21, 906, 076	1, 204, 588
1892	11, 460, 681	368, 926
1893	11, 056, 287	883, 842

G. D. BRYAN,
Collector

LETTER OF MR. E. WILLIS, CHARLESTON, S. C.

Business here shows the same shrinkage found in all seaport towns from Main Texas. Values have dwarfed, in many instances volume of business just as mu and falling off will be fully one-half. We are here commercially prosperous, w sound banks, deep water, good water-front facilities for handling all classes of m chandise exported or imported. Our cotton, rice, phosphate, fertilizers, turpenti and rosin, lumber and cross-ties, and cotton goods on good basis, nearly all whar repaired, and jetties daily improving the bar and harbor for commerce.

Export trade of Charleston from January 1, 1893, to December 31, 1893.

Articles.	Number.	Tons.	Value.
d cotton … bales	385,101	98,000	$14,404,040
land cotton … bags	5,900	1,000	501,500
… casks	95,000	17,000	1,500,000
… barrels	125,000	28,000	250,000
ntine … casks	25,000	4,000	275,000
hate rock		350,000	1,750,000
izers … sacks	3,256,180	324,600	4,884,250
er … feet	70,000,000	1,400,000	850,000
n goods … bales	70,000	18,000	4,000,000
n-seed meal and cake		3,000	65,000
n … casks	14,000	12,000	125,000
ables and fruits … crates	384,687	17,500	3,000,000
berries … quarts	550,000	600	55,000
s … carloads	1,200	48,000	200,000
llaneous		75,000	140,000
Total		2,396,700	31,999,790

Import trade of Charleston from January 1, 1893, to December 31, 1893.

Articles.	Number.	Tons.	Value.
		21,000	$3,250,000
… barrels	225,000	20,000	1,000,000
… bushels	1,150,000	27,500	550,000
… bales	62,000	5,500	125,000
… bushels	260,000	6,000	130,000
and meal … barrels	175,000	4,000	350,000
… do	120,000	16,500	1,400,000
ses … do	9,000	1,300	180,000
… sacks	40,000	4,000	24,000
land cotton bagging … yards	25,000	50	8,000
bagging and burlaps … do	5,000,000	9,000	400,000
utts … bales	23,798	5,009	200,000
eum and other oils … barrels	11,500	1,800	125,000
		40,000	240,000
… number	10,000,000	2,000	750,000
co … pounds	1,500,000		
, stationery, etc		1,800	378,500
ries and dry goods		120,000	20,000,000
are		70,000	2,000,000
and shoes		12,000	1,000,000
ry		8,000	350,000
and medicines		3,000	870,000
granite, rubble, marble, brownstone		209,000	495,500
g and paving stone		4,000	
		8,000	60,000
ar, brimstone		9,000	225,000
soda, manure, salt		1,500	45,000
te of potash		1,600	60,000
s		14,192	41,000
cement, and brick		15,000	35,000
actures		50,000	12,500,000
zers		1,500	12,000
Total		692,251	46,804,000

THE CARS TO THE SHIPS.

1887 Charleston city council granted a charter to the East Shore Terminal Com-
with power to own and operate cotton presses, storage warehouses, wharves,
railway along the city's eastern or Cooper River front. The result has dem-
ated the wisdom of the grant. To-day the East Shore Terminal Company not
wns and operates the Union and Commercial Cotton Compresses, whose daily
ity is 3,350 bales, but 30 storage warehouses, 14 wharves, and a double-track
y along the entire water front from Columbus street to Southern Wharf.
railway not only connects with all railway lines coming to Charleston, but it
acks to many industries located along its line and to the extreme end of sev-
its wharves, which permits the loading and unloading of cars within the
diate reach of the ship's tackle. This is a facility that very few ports enjoy

and one that is becoming highly appreciated by shippers. To these facilities is largely due the fact that the past year Charleston has handled 109,612 more bales of cotton than last year; also that its foreign exports for eight months ending February 1, 1894, were $28,439.49 greater than for the same period in 1893.

THE WEST SHORE TERMINAL.

Since the last report considerable extension has been made to this valuable property. Spacious sheds and overhead railroads for the handling of freights have been built as well as broad and spacious slips for the handling of vegetables going to the Northern markets, the slips permitting the free use of all kinds of boats used in this growing traffic. During the past year a large quantity of oak and pine railroad ties passed over this water front; the principal commodity, however, handled here was acid phosphate and phosphate rock going to interior points in the South and West. The volume of brimstone, salt, and pyrites was not as large as for the previous year, but the volume of lumber for 1893 and 1894 was greater than for 1892 and 1893.

E. WILLIS.

M 11.

IMPROVEMENT OF ASHLEY RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see Appendix S 8, Annual Report for 1873.

ORIGINAL CONDITION.

The river was obstructed by two shoals, with not over 9 feet of water on them.

PLAN OF IMPROVEMENT.

A depth of from 10 to 11 feet was to be secured by dredging.

WORK PRIOR TO JUNE 30, 1893.

Twenty-six thousand one hundred and twenty-five cubic yards of material had been removed, and the desired depth had been obtained and maintained. Dividing the total expenditures for all purposes to June 30, 1893, by the above number of cubic yards dredged shows the cost to have been 21 cents per cubic yard. All dredging was done by contract.

WORK OF PAST YEAR.

No work was done on account of lack of funds. The balance on hand July 1, 1894, is $1.77.

REMARKS.

No new transportation lines have been established on this river during the year. The improved reaches are in satisfactory condition. Attention is again called to the fact that the phosphate mining companies are still in some instances washing their sand into the river, and are greatly injuring the channel thereby.

Appended to this report is a statement prepared by Mr. E. Willis, of Charleston, giving the required freight statistics. During the year the freight passing over this stream has aggregated 525,000 tons.

The river is tributary to the collection district of Charleston, S. C. Charleston is its port of entry. Amount of duties collected in the calendar year of 1893, $16,689.75.

For this improvement the following appropriations have been made:

By act of Congress approved—	
June 14, 1880	$1,000.00
March 3, 1881	1,500.00
July 5, 1884	2,000.00
August 5, 1886	1,000.00
Total	5,500.00
Total expenditures to June 30, 1894	5,498.23

Money statement.

July 1, 1893, balance unexpended	$2.81
June 30, 1894, amount expended during fiscal year	1.04
July 1, 1894, balance unexpended	1.77

COMMERCIAL STATISTICS.

LETTER OF MR. E. WILLIS.

This stream is by far the most active and important one in the State. Though short, and in many places shallow, it is a home of industry for about nine months during the year. It is the busiest scene in the low country, for it has on its banks the Wappoo Mills, Chisolm Mill, West Point Mill, Halsey's (Toale Mill), Deveraux, Steinmeyer, Atlantic, Wando, Stono, Ashley, Ashepoo, Chicora, Royal, Imperial, Bouker, and Rose Mines, Charleston Mining and Manufacturing Company's Work, Magnolia Mines of C. C. Pinckney, Drayton Mines, Gregg Mines, Palmetto Mines, Archdale Mines. The falling off in value thus from last year is mainly attributable to falling off in use of sulphur and kainit.

Commercial statistics, Ashley River, South Carolina.

	Phosphate rock.		Sulphur, kainit, blood, potash, cotton-seed meal, pyrites tankage, etc.		Timber, lumber, shingles, cross-ties, hoop poles, etc.		Miscellaneous.		Total value.
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	
1888	....	$1,045,000	....	$750,000	....	$30,000	....	$25,000	$1,850,000
1889	....	1,200,000	....	800,000	....	35,000	....	30,000	2,065,000
1890	250,000	1,600,000	50,227	900,000	10,000	40,000	5,000	40,000	2,580,000
1891	300,000	2,100,000	98,800	1,016,000	12,500	50,000	4,500	30,000	3,196,000
1892	310,000	1,600,000	125,000	1,250,000	20,000	125,000	10,000	50,000	3,025,000

January 1, 1893 to December 31, 1893.

Articles.		Number.	Tons.	Value.
Phosphate rock		....	304,600	$1,475,000
Sulphur, kainit, blood, potash, cotton-seed meal, pyrites		....	145,000	475,000
Timber, lumber, shingles, and cross-ties, poles, etc.	feet	30,000,000	....	225,000
Miscellaneous		....	16,000	90,000
Total		....	....	2,265,000

M 12.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project, see p. 1073, Annual Report for 1881. For modified project, see p. 1196, Annual Report for 1889.

ORIGINAL CONDITION.

Wappoo Cut was a narrow, crooked, tidal stream, with but little depth, connecting Ashley and Stono rivers.

PLAN OF IMPROVEMENT.

The project provides for securing a sufficiently straight and continuous channel 60 feet wide between low-water lines and 6 feet deep at low water from Ashley to Stono rivers. The bulk of the work is dredging. To maintain the channel, two training walls at Stono entrance and three closing dams are to be made and some bank protection done. The estimated cost is $88,000.

WORK PRIOR TO JUNE 30, 1893.

One hundred and eighty-three thousand seven hundred and ninety-two cubic yards of dredging had been done. A number of snags, stumps, and overhanging trees had been removed, and a bulkhead had been built across the mouth of Pompey Cut. A brush and stone dam 220 feet long had been built to close the old route just east of Elliott Cut at a cost of $3,200. The south side of Elliott Cut had been revetted with stone for a length of 1,300 feet, and the north side for a length of 1,260 feet, at a cost of $6,100, or $2.38 per running foot. Dividing the balance of the total expenditures for all purposes to June 30, 1893, by the above number of cubic yards excavated, shows that the average cost per cubic yard for dredging has been 22 cents. All work has been done by contract.

WORK OF PAST YEAR.

No work has been done as no shoals had formed, and the balance on hand was too small to extend the stonework on the banks of Elliott Cut economically.

REMARKS.

Two new transportation lines have been established through this cut during the year. During the year the freight passing over this stream has aggregated 242,000 tons. Attention is invited to the appended report of my assistant engineer, Mr. James P. Allen, which shows that this work has been very successful. No shoaling of importance has occurred since dredging was discontinued, and the new cut-off east of Elliott Cut has removed the tendency, formerly existing, to fill up at the mouth of Pompey Cut, which was the cause of much trouble to navigation and of much expense to the Government for redredging. The revetment of the bluffs in Elliott Cut appears to have ended the trouble from shoaling in that reach.

The balance of $2,715.72 on hand July 1, 1894, will be held to maintain the present channel by dredging at any point that may become shoal, unless further funds are provided during the year. In that case it will be combined with the new appropriation and put into stonework on the banks of Elliott Cut and on a breakwater at the Stono mouth.

This work is in the collection district of Charleston, S. C., which is the port of entry. Amount of duties collected in the calendar year of 1893, $16,689.75.

The following appropriations have been made for this improvement:

By act of Congress—	
Approved March 3, 1881	$10,000.00
Passed August 2, 1882	10,000.00
Approved July 5, 1884	3,000.00
Approved August 5, 1886	5,000.00
Of August 11, 1888	5,000.00
Approved September 19, 1890	10,000.00
Approved July 13, 1892	10,000.00
Total	53,000.00
Total expenditures to June 30, 1894	50,284.28

Money statement.

July 1, 1893, balance unexpended	$2,715.72
July 1, 1894, balance unexpended	2,715.72
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	35,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. JAMES P. ALLEN, ASSISTANT ENGINEER.

United States Engineer Office,
Charleston, S. C., June 30, 1894.

Captain: I have the honor to submit the following annual report for Wappoo Cut, South Carolina:

No work was done in continuance of this improvement during the past fiscal year.

A careful survey was made in April, 1894, covering the whole improved portion, except the Ashley mouth.

This survey shows that no dredging is immediately needed. The 6-foot curve goes through, with the exception of about 800 feet near Stono River, where there is a depth less than 6 feet at low water. The money which was reserved for dredging is still held, and can go toward bank protection or other work when more funds are available.

The dam and bank protection are in good condition.

The former is not so high as when first built, either on account of settlement or because of stones having been rolled off of the top. The western end of the bank protection on the north side consisted of a longitudinal stone pile at the foot of the bluff bank. This is somewhat scattered, but has served its purpose well, and is still in good condition. The end to be gained in the bank protection used for this work seems to be the securing of the foot of the bluff. If this is done successfully, the beach between high and low water will wash away very slowly and but little material will be supplied to form shoals. This work has had an unusually severe test in the hurricanes which occurred in August and October, 1893. The first of these was probably the most severe that has visited this section in a century. The tide was the highest of which we have authentic record. The fact that the dams and shore protections have shown so little deterioration under the strain speaks well for their permanence.

The survey shows that the bend in the old route which was closed by the dam built in 1893 is rapidly filling up. The shoal shown by the last survey just west of Marsh Cut of 1891 has disappeared. There has been heretofore a tendency to shoal rapidly just west of the Marsh Cut of 1883, but this survey shows a good 6-foot channel at that point. The marsh is growing gradually across both Pompey Cut and the old bed of Wappoo Creek, just west of Marsh Cut of 1883, so that it seems likely that these will disappear in time as side branches, and with their disappearance rapid shoaling will doubtless cease at these two points. A good channel exists at the Stono mouth. There appears to be some encroachment of sand from the north, but it has scoured out to the south, so that while the channel generally maintains its width, it is not so straight as it was when dredged, but curves slightly, with the conve toward the south. The improvement seems to be eminently successful, so far a has been carried.

The break in the 6-foot curve, already alluded to, occurs at a point in Elliott C where the banks have not yet been protected, and is probably accounted for by th fact. It is likely that upon the completion of the bank-protection no more sh ing will occur here. The building of the jetty, proposed in the project, at the Sto mouth will check the tendency of material to work into the cut from the north, a it will be easier to keep a straight channel at the Stono entrance.

Two new transportation lines have been established during the year, one of the being only temporary for the season of early vegetables. There are now, includ the above, 5 steamers and 2 tugs making regular trips through Wappoo Cut.

Very respectfully, your obedient servant,

JAMES P. ALLEN,
Assistant Engine

Capt. FREDERIC V. ABBOT,
Corps of Engineers, U. S. A.

LETTER OF MR. E. WILLIS.

Wappoo Cut, South Carolina, connecting Stono River with the city, and giv John's, James, Kiawah, Cole, Folly, and Edisto islands a safe passage, for there no longer any dreaded mud flats to encounter either day or night in navigation, a there is a fair business passing this way.

Commercial statistics, Wappoo Cut, South Carolina.

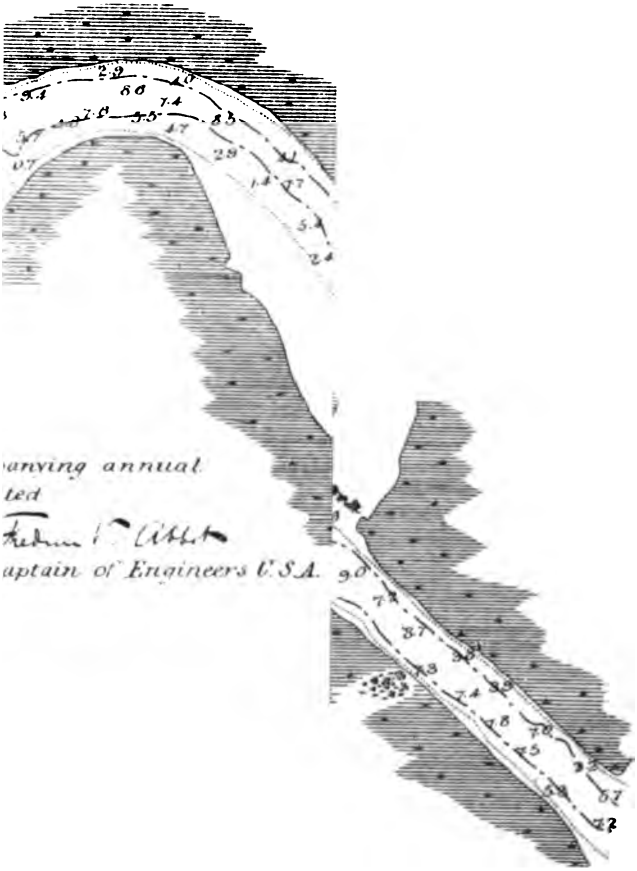
Articles.	1888.		1889.	
	Quantity.	Value.	Quantity.	Value
Phosphate rock ......tons..	60,000	$300,000	70,000	$473,
Sea-island cotton ......bags..	6,000	360,000	10,000	751,
Rice ......bushels..	150,000	150,000	250,000	362,
Vegetables ......crates..	120,000	240,000	80,000	125,
Fertilizers ......tons..	2,000	30,000	2,500	40,
Lumber ......feet..	20,000,000	160,000	22,500,000	198,
Shingles, cross-ties, and other articles......	......	......	......	25,
Total	......	1,240,000	......	1,867,

Articles.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value
Phosphate rock ......tons..	75,000	$525,000	65,000	$301,
Sea-island cotton ......bags..	12,000	800,000	10,000	854,
Rice ......bushels..	240,000	250,000	400,000	360,
Vegetables ......crates..	90,000	160,000	95,000	290,
Fertilizers ......tons..	1,400	21,000	3,000	37,
Lumber ......feet..	25,000,000	200,000	30,000,000	275,
Shingles, cross-ties, and other articles......	......	20,000	50,000	35,
Total	......	1,976,000	......	1,987,

Commercial statistics from January 1 to December 31, 1893.

Articles.	Number.	Tons.	Value
Phosphate rock	......	78,500	$395,
Sea-island cotton ......bags..	5,000	......	450,
Rice ......bushels..	360,000	......	350,
Vegetables ......crates..	120,000	......	290,
Fertilizers......	......	4,300	78,
Lumber ......feet..	35,000,000	......	290,
Shingles and other articles	......	60,000	50,
Total......	......	242,000	1,905,

E. WILLIS



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UNIV. OF MICH.

M 13.

IMPROVEMENT OF EDISTO RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1140, Annual Report for 1881.
r modified project see p. 1168, Annual Report for 1889.

ORIGINAL CONDITION.

The river was choked with snags and had many half-formed natural -offs.

PLAN OF IMPROVEMENT.

The project provides for snagging, etc., to give easy navigation for fts and flatboats from Guignards Landing to the mouth of the river, istance of about 260 miles, at an estimated cost of $33,385.

WORK PRIOR TO JUNE 30, 1893.

The river had been snagged between points 260 miles (Guignards anding) and no miles above the mouth, 45,468 logs, snags, and over-nging trees, etc., having been removed from the channel and banks. umerous outlets into the swamps had been closed, and one large nat-al cut-off had been opened and made the main channel of the river.

The river and harbor act of September 19, 1890, in providing for this provement, contains a requirement that the money appropriated ould be spent in equal portions in the North and South forks. In cordance therewith work under this appropriation was commenced ar Orangeburg, on the North Fork, and at New Bridge, on the South ork, and no work was done on the main river below the "forks." he original project did not provide for any work on the North Fork the Edisto River, and, therefore, the $2,500 provided for such work ould not be charged against the original estimated cost of this provement.

The North Fork was roughly cleared for raft navigation for width 60 feet and depth of 18 inches at low water between Orangeburg idge and the "forks." Dividing the total expenditures to June 30, 93, for all purposes by the above number of obstructions removed ows the average cost to have been 72 cents for each obstruction.

WORK OF PAST YEAR.

No work was done, as the funds in hand were insufficient.

REMARKS.

The hurricanes in August and October, 1893, have caused some structions to fall into the river, and $2,500 could now be expended advantage in removing them. This would not cause the appropria-ons to really exceed the original estimate for Edisto River, as this nount was diverted from the main stream to a tributary by the act of ptember 19, 1890, as above stated.

No new lines of transportation have been established on this river ring the year. The balance of $374.70 on hand July 1, 1894, will be ld in hand for maintenance.

During the year the freight passing over this stream has gated 120,870 tons.

This river is tributary to the collection district of Charleston S. C. on the north and Beaufort on the south are the nearest ports of entry. on imports collected in the calendar year 1893 at the custom-house at $16,689.75; at Beaufort, $9.

For this improvement the following appropriations have been

By act of Congress—
  Passed August 2, 1882..
  Approved July 5, 1884..
  Approved August 5, 1886..
  Of August 11, 1888..
  Approved September 19, 1890..
  Approved July 13, 1892..

  Total..
Total expenditures, including June 30, 1894..

For table of commercial statistics furnished by the collect Charleston, S. C., see this year's annual report for Charleston For table of commercial statistics furnished by the collector of S. C., see this year's annual report for Salkehatchie River.

Money statement.

July 1, 1893, balance unexpended..
June 30, 1894, amount expended during fiscal year..

July 1, 1894, balance unexpended..
July 1, 1894, outstanding liabilities..

July 1, 1894, balance available..

Amount (estimated) required for completion of existing project ......
Amount that can be profitably expended in fiscal year ending June 30, 1896
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

LETTER OF MR. J. D. ACKERMAN.

COTTAGEVILLE, S. C., *May 30,*

DEAR SIR: I beg herewith to send you a report of the commerce passing Edisto River during the year from June 1, 1893, to May 30, 1894.

Articles.	1887.		1888.		1889.
	Quantity.	Value.	Quantity.	Value.	Quantity.
Sawed lumber ..feet, B. M..	30,000,000	$240,000.00	32,000,000	$256,000.00	32,500,000
Hewn timber..........feet..	15,000,000	90,000.00	15,000,000	90,000.00	18,000,000
Round timber..linear feet..	1,500,000	75,000.00	2,000,000	100,000.00	1,500,000
Cross-ties............ feet..	38,000	3,500.00	60,000	4,800.00	2,000,000
Rice ....bushels..	124,982	149,970.40	130,114	156,136.68	128,340
Naval stores.......barrels..	....	....	....	....	....
Wood....................	....	....	....	....	....
Phosphate............tons..	....	....	....	....	....
Miscellaneous, cord wood, etc..................	....	10,000.00	....	8,000.00	....
Total..................	....	568,478.40	....	614,936.68	....

COMMERCIAL STATISTICS—Continued.

Articles.	1890.		1891.		1892.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ed lumber..feet, B. M..	35,000,000	$280,000.00	37,000,000	$296,000.00	35,500,000	$284,000.00
n timber..........feet..	17,000,000	102,000.00	12,000,000	72,000.00	11,000,000	66,000.00
nd timber..linear feet..	1,500,000	75,000.00	1,500,000	75,000.00	1,200,000	60,000.00
s-ties..............feet..	2,500,000	200,000.00	2,000,000	160,000.00	1,200,000	96,000.00
................bushels..	128,796	154,555.20	130,760	156,912.00	135,850	135,850.00
al stores.......barrels..	900	3,600.00	6,200	4,800.00	800	3,200.00
od..........................	....	....	....	7,000.00	....	8,000.00
sphate............tons..	....	....	25,000	125,000.00	25,000	125,000.00
cellaneous, cord wood, c..........................	....	8,000.00	....	....	....	....
Total..................	....	823,155.20	....	896,712.00	....	778,050.00

Articles.	1893.		
	Number.	Tons.	Value.
ed lumber....feet, B. M..	30,000,000	60,000	$240,000.00
n timber....feet..	10,000,000	20,000	60,000.00
nd timber....linear feet..	850,000	22,000	42,500.00
s-ties....feet..	575,000	11,500	46,000.00
ress timber....do....	1,600,000	3,200	96,000.00
d....	....	2,000	8,000.00
....bushels..	65,000	1,170	45,000.00
al stores....barrels..	500	1,000	2,000.00
Total....	....	120,870	539,500.00

onnage for the year, 120,870.

here is no new transportation line operating on this river during the present r.

Very respectfully, your obedient servant,

J. D. Ackerman.

apt. F. V. Abbot,
U. S. Engineer.

M 14.

IMPROVEMENT OF SALKEHATCHIE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1144, Annual Report for 1881.

ORIGINAL CONDITION.

The river was choked with logs and snags, and in some places was ided into small branches by numerous low-lying islands.

PLAN OF IMPROVEMENT.

The project provides for clearing the channel for rafts and flatboats m a point 5 miles above Toby Bluff to Hickory Hill, 46 miles above river mouth, a total length of 77 miles, at an estimated cost of 3,000.

WORK PRIOR TO JUNE 30, 1893.

The river had been snagged between points 46 miles and 123 miles ve the mouth, 13,206 logs, snags, overhanging trees, etc., having en removed from the channel and banks. Over 181 outlets into the swamp were closed; a dam was built to remove a local shoal; one natural cut-off was widened and made the main channel of the river, and one bad cut-off was closed. Dividing the total expenditures to June 30, 1893, by the above number of obstructions removed shows the average cost to have been $1.08 for each obstruction removed and outlet closed. The latter really cost more and the snags less, but the reports do not afford data to proportion the expenses.

WORK OF PAST YEAR.

The hurricanes of August and October threw a large number of trees into the river. Work was resumed, and the new obstructions were removed at a cost of about $1.36 each. The river is now in good order.

REMARKS.

No new transportation lines have been established on the river during the year. With the balance of $2,621.15 on hand July 1, 1894, the river will be maintained in fair rafting order.

The appropriation of September 19, 1890, completed the estimated cost for this improvement. A considerable balance is held in hand to maintain the river in a navigable condition in the future. During the year the freights passing over this stream have aggregated 27,000 tons.

This river is tributary to the collection district of Charleston, S. C. Beaufort is the nearest port of entry. Duties on imports collected at the custom-house at Beaufort, S. C., in 1893, $9.

For this improvement the following appropriations have been made:

By act of Congress—	
Passed August 2, 1882	$5,000.00
Approved July 5, 1884	3,000.00
Approved August 5, 1886	2,000.00
Of August 11, 1888	3,000.00
Approved September 19, 1890	5,000.00
Total	18,000.00
Total expenditures, including June 30, 1894	15,378.85

Money statement.

July 1, 1893, balance unexpended	$3,758.34
June 30, 1894, amount expended during fiscal year	1,137.19
July 1, 1894, balance unexpended	2,621.15
July 1, 1894, outstanding liabilities	12.00
July 1, 1894, balance available	2,609.15

REPORT OF MR. JAMES P. ALLEN, ASSISTANT ENGINEER.

CHARLESTON, S. C., *June 30, 1894.*

CAPTAIN: I have the honor to submit the following annual report for Salkehatchie River, South Carolina:

It had not been intended to do any work on this river during the year, but the hurricanes of August and October, 1893, did so much injury to the improved portion, that you decided to expend a part of the amount in hand removing obstructions thrown into the river by these storms.

Work began in November, 1893, and continued to February 23, 1894. Eighteen trees and 2 cords of brush were cut from the banks and 495 logs, 22 stumps, and

299 cords of small snags have been removed from the channel, and one outlet stoppage at Dubois Sand Drag was repaired. Work extended from Marr Landing, which is about 6 miles above Toby Bluff and the practical upper limit of the improvement, to 2 miles above the Charleston and Savannah Railroad bridge. About 62 miles of river were worked over, from 61 miles to 123 miles above the mouth. On the upper portion a channel about 20 feet wide and 1 foot deep at low water was secured. On the lower portion the effort was to get 60 feet wide and 1¼ feet deep at low water. Probably not over one-twentieth of the amount expended was upon banks, as will be seen by the relative number of obstructions removed. It was the object of the work primarily to open a channel by the removal of obstructions recently fallen in.

Some portions were very badly obstructed, as for example, immediately above Niles bridge and for some distance below Capers Lake.

The obstructions when removed were placed, as heretofore, behind sandy points or across the heads of sucks. Some of the smaller branches and timbers were burned in the camp fires.

The total cost of the work was $1.36 per obstruction removed. This is not excessive when it is considered that the work was mainly in the channel.

There have been no new transportation lines established on the river, nor new bridges built across the improved portion during the year. The county bridge at Toby Bluff is in bad condition, and interferes somewhat with raft navigation at the higher stages.

The work was under the supervision of Mr. W. D. Niles, who has been as usual attentive and faithful in the discharge of his duties.

Very respectfully, your obedient servant,

James P. Allen,
Assistant Engineer.

Capt. Frederic V. Abbot,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

LETTER OF MR. W. D. NILES.

Beaufort, S. C., *May 24, 1894.*

Dear Sir: In compliance with your request I submit the following report of commercial statistics of the Salkehatchie River, South Carolina, for 1893. The data for this report I obtained from men having knowledge of the business on the river:

Articles.	1887.		1888.		1889.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Lumber, sawed .... feet, B. M..	4,450,000	$32,050	3,000,000	$30,000	3,500,000	$31,500
Timber .... do....	....	....	400,000	2,000	160,000	800
Cross-ties .... number..	41,000	13,120	40,000	12,000	17,000	4,590
Rice .... bushels..	200,000	250,000	170,000	200,000	175,000	218,750
Naval stores .... casks..	2,125	38,875	2,000	36,000	2,000	34,000
Rosin .... barrels..	9,798	15,000	8,000	16,000	8,000	12,000
Miscellaneous	....	....	....	4,000	....	10,000
Total	....	342,045	....	300,000	....	311,640

Articles.	1890.		1891.	
	Quantity.	Value.	Quantity.	Value.
Lumber, sawed .... feet, B. M..	3,000,000	$27,000	100,000	$900
Timber .... do....	....	....	3,500,000	31,500
Cross-ties .... number..	....	....	15,000	4,500
Rice .... bushels..	200,000	250,000	175,000	200,000
Naval stores .... casks..	450	8,100	115	2,300
Rosin .... barrels..	4,500	6,750	1,125	1,400
Miscellaneous	....	5,000	....	....
Total	....	296,850	....	240,600

COMMERCIAL STATISTICS—Continued.

Articles.	1892.		1893.	
	Quantity.	Value.	Quantity.	Value.
Lumber, sawed .... feet, B. M.	5,300,000	$53,000	....	....
Timber, hewed .... do.				
Railroad cross-ties				
Lumber, timber .... feet, B. M.	....	....	7,900,000	$79,000
Railroad cross-ties .... number	....	....	61,700	18,510
Rice .... bushels	225,000	135,000	35,000	21,000
Rosin .... barrels	1,000	1,500	....	....
Wood, shingles, etc	....	....	....	3,000
Total	....	189,500	....	121,510

The cyclone of August 27 nearly ruined the rice crop of that part of the river called Combahee.

Respectfully, yours,

W. D. Niles.

Capt. F. V. Abbot,
Corps of Engineers, U. S. A.

Arrivals and clearances of vessels and commerce at Beaufort, S. C., from January 1, 1888, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	103	121,207	2,630	3	1,093	26	30	21,785	422	136	144,085	3,078
1889	98	128,834	2,728	2	1,461	19	58	54,464	1,096	158	230,193	3,843
1890	43	49,173	927	7	2,987	75	52	48,656	972	102	100,816	1,974
1891	37	40,145	786	3	1,567	26	22	21,503	416	62	63,215	1,228
1892	29	34,979	607	1	896	9	37	43,526	771	67	79,401	1,387
1893	40	51,967	854	4	3,101	38	36	45,774	771	80	100,842	1,663

CLEARED.

Year.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	57	63,287	1,566	3	1,465	33	78	85,523	1,561	138	150,275	3,160
1889	57	73,744	1,872	....	....	......	98	99,898	1,944	155	173,642	3,816
1890	12	6,436	127	1	101	14	88	94,285	1,828	101	100,822	1,969
1891	7	3,921	75	....	....	......	51	56,300	932	58	60,221	1,007
1892	7	4,268	92	....	....	......	59	72,702	1,264	66	76,970	1,356
1893	6	6,313	110	1	296	8	67	92,248	1,494	74	98,857	1,612

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$850,393.00	$65,645.36	$17.00
1889	1,083,085.00	24,266.00	160.00
1890	1,040,197.00	41,005.00	....
1891	627,851.00	137,942.54	31.50
1892	791,554.00	77,751.49	....
1893	2,251,685.50	19,278.31	9.00

Marion M. Hutson,
Collector of Customs.

M 15.

IMPROVEMENT OF BEAUFORT RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see p. 1235, Annual Report for 1890.

ORIGINAL CONDITION.

There was a thoroughly good 7-foot channel between the town of Beaufort and Coosaw River, except at a point called Brickyard, near Coosaw mouth. The least depth here was about 4 feet at low water, and the channel when deep enough was too narrow.

PLAN OF IMPROVEMENT.

It is proposed to deepen and widen the channel by dredging sufficiently to give a continuously wide 7-foot channel at low water all the way through. The estimated cost is $40,000.

WORK PRIOR TO JUNE 30, 1893.

Sixty-nine thousand nine hundred and sixty-seven yards had been dredged, of this 1,339 cubic yards was rock. Dividing the total expenditures for all purposes to June 30, 1893, by the above number of cubic yards dredged, shows the average cost to have been 36 cents per cubic yard. All work was done by contract.

WORK OF PAST YEAR.

Lack of funds has prevented work.

REMARKS.

No new transportation lines have been established on this river during the year.

The balance of $29.07 on hand July 1, 1894, will be retained until further funds are provided by Congress.

During the year the freight passing over this stream has aggregated about 215,000 tons.

This river is in the collection district of Beaufort, S. C. Beaufort is the port of entry. Amount of duties collected in the calendar year of 1893, $9.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved September 19, 1890	$12,500.00
Approved July 13, 1892	12,500.00
Total	25,000.00
Total expenditures, including June 30, 1894	24,970.93

For table of commercial statistics furnished by the collector of Beaufort, S. C., see this year's annual report for Salkehatchie River, South Carolina.

Money statement.

July 1, 1893, balance unexpended	[illegible]
June 30, 1894, amount expended during fiscal year	[illegible]
July 1, 1894, balance unexpended	[illegible]
July 1, 1894, outstanding liabilities	[illegible]
July 1, 1894, balance available	[illegible]
Amount (estimated) required for completion of existing project	15,00
Amount that can be profitably expended in fiscal year ending June 30, 1896	15,00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce in 1891.

Articles.		1891.	
		Quantity.	Value.
Lumber, timber, railroad ties	feet	4,120,000	[illegible]
Shingles	number	100,000	[illegible]
Wood	cords	600	[illegible]
Coal	tons	7,300	[illegible]
Phosphate, rock	do	178,000	[illegible]
General merchandise, machinery, hardware, etc	do	9,150	[illegible]
Lint cotton, seed cotton	do	1,600	[illegible]
Rough rice	do	1,000	[illegible]
Total			[illegible]

Aggregate tons of freight transported through Brickyard Creek during the yea was 202,235 tons.

Aggregate tonnage, value, and number of trips of vessels passing through that part Beaufort River, South Carolina, known as Brickyard Creek during the year 1891.

No.	Class.	Aggregate tonnage.	Aggregate value.	Aggregate number trips.
3	Passenger boats	900	$40,000	[illegible]
16	Tugboats	1,000	170,000	[illegible]
37	Dredges, wash boats, lighters	6,000	280,000	[illegible]
20	Coastwise vessels	10,000	500,000	[illegible]
	Steam pleasure yacht	250	203,000	[illegible]
30	Small boats from 2 to 50 tons	400	12,000	[illegible]
3	Pilot boats	100	10,000	[illegible]
2	Revenue cutter	1,100	160,000	[illegible]
1	Buoy tender			
1	Fish Commission boat			
	Total	19,750	1,375,000	[illegible]

Five thousand passengers passed over the creek during the year.

STATEMENT OF MR. W. D. NILES.

SIR: In accordance with your request, I submit the following report of commercial statistics for the year 1892 of that part of Beaufort River, South Carolina, known as Brickyard Creek. The data for this report I obtained from the written and verbal statements of the business men of the river.

Articles.	Quantity.	Value.
Phosphate, rock ....tons..	200,000	$880,000
General merchandise, machinery, hardware, etc ....do...	10,000	300,000
Lint cotton, seed cotton, cotton seed ....do...	11,000	200.000
Rough rice ....do...	1,000	30,000
Coal ....do...	10,000	40,000
Lumber, timber, railroad ties ....feet B. M..	5,120,000	51,500
Shingles ....number..	100,000	500
Wood ....cords..	1,000	3,000
Total ....tons..	250,000	1,505,000

Aggregate tonnage, value, and number of trips of vessels passing through that part of Beaufort River, South Carolina, known as Brickyard Creek during the year 1892.

No.	Class.	Aggregate tonnage.	Aggregate value.	Aggregate number trips.
3	Passenger boats	900	$40,000	225
18	Tugboats	1,100	180,000	1,550
37	Dredges, wash boats, lighters	6,000	280,000	5,500
20	Coastwise vessels	10,000	500,000	20
10	Steam pleasure yachts	300	200,000	30
30	Small boats from 2 to 50 tons	400	1,200	500
3	Pilot boats	100	10,000	75
2	Revenue cutters	700	175,000	50
1	Buoy boat			
	Total	19,500	1,386,200	7,950

W. D. NILES.

Capt. F. V. ABBOT,
Corps of Engineers, U. SA.

LETTER OF MR. W. D. NILES.

SIR: I hereby comply with your request and submit the following statistical report of the commerce of that part of Beaufort River, South Carolina, known as Brickyard Creek. The data for this report I obtained from the written and verbal statements of men doing business over the river. This report is for the year 1893.

Articles.	Number.	Tons.	Value.
Phosphate rock	....	180,000	$900,000
General merchandise	....	2,250	112,500
Cotton seed	....	50	1,000
Sea island and upland cotton	....	60	25.000
Coal	....	6,000	25.000
Lumber and timber ....feet, B. M..	7,900.000	25,140	79.000
Railroad ties	61.700		18,500
Wood, shingles, brick, hardware, machinery, etc	....	1,500	20,000
Total	....	215,000	1,181,000

The cyclone lessened the output of phosphate rock fully 50,000 tons. The transportation of cotton, cotton seed, and merchandise was also less on account of the cyclone of August 27 of this year, 1893.

Aggregate tonnage, value, and number of trips of vessels passing through that part of Beaufort River, South Carolina, known as Brickyard Creek during the year 1893.

No.	Class.	Aggregate tonnage.	Aggregate value.	Aggregate number of trips.
3	Passenger boats	900	$40,000	150
18	Tugboats	1,100	130,000	1,300
37	Wash boats, dredges, and lighters	6,000	250,000	4,000
20	Coastwise vessels	10,000	500,000	20
10	Steam pleasure yachts	300	200,000	30
30	Small boats from 2 to 50 tons	400	1,200	400
3	Pilot boats	100	10,000	50
2	Revenue cutters	700	175,000	50
1	Buoy tender			
	Total	19,500	1,306,200	6,000

The tugboats, wash boats, dredges, and lighters were badly damaged by the August cyclone.

W. D. NILES.

Capt. F. V. ABBOT,
Corps of Engineers, U. S. A.

M 16.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK OF SCHOONER KATE V. AITKEN IN SWASH CHANNEL, CHARLESTON HARBOR, SOUTH CAROLINA.

At the close of the last fiscal year a contract was let to Messrs. Charles W. Johnston and Enoch Townsend to remove this wreck for the sum of $4,745. They began work and succeeded in removing a portion of the vessel, but from the start failed to comply with the specifications regarding the disposition of cargo and vessel. After cutting the wreck down to about the level of the sand they stopped work on the plea that it was impossible to do more, although the contract called for the complete removal of the wreck. They asked for part payment. The question was referred finally to the Second Comptroller, and it was decided that no payment at all could be made. They then requested an extension of time, which was granted them. Up to the close of the fiscal year they had not resumed work. Their extension of time expires August 31, 1894.

WRECK OF SLOOP IN DRAW SPAN OF THE ASHLEY RIVER BRIDGE.

During the gale of August 27, 1893, a small sloop sunk in over 30 feet of water in the draw opening of the above bridge. Her mast is an obstruction to navigation; the rest of the boat is so deeply submerged as to be out of the way. Five dollars was allotted for removing the mast. At the close of the year this had not been done, as the parties who were repairing the bridge had promised to pull it out for that price, but had failed to do so.

The expenditures during the year have aggregated $366.67.

APPENDIX N.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA.

REPORT OF CAPT. O. M. CARTER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. **Savannah Harbor, Georgia.**
2. **Savannah River, Georgia.**
3. **Savannah River above Augusta, Ga.**
4. **Darien Harbor, Georgia.**
5. **Altamaha River, Georgia.**
6. **Oconee River, Georgia.**
7. **Ocmulgee River, Georgia.**
8. **Brunswick Harbor, Georgia.**
9. **Brunswick Outer Bar, Georgia.**
10. **Jekyl Creek, Georgia.**
11. **Cumberland Sound, Georgia.**
12. **Inside water route between Savannah, Ga., and Fernandina, Fla.**
13. **Removing sunken vessels or craft obstructing or endangering navigation.**

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 2, 1894.

GENERAL: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1894, upon the works of river and harbor improvements then in my charge.

Very respectfully, your obedient servant,

O. M. CARTER,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

N I.

IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA.

Operations for improving this harbor have been carried on during the last fiscal year in accordance with a project of improvement approved by the Secretary of War July 22, 1890, and printed as part of Appendix O 1, Annual Report of the Chief of Engineers for 1890. For a special history of past work, see pp. 1012–1023, Annual Report of the Chief of Engineers for 1888, and the annual reports of the same officer since that date.

ORIGINAL CONDITION.

In 1873, before the work of improvement was inaugurated, the usual draft of vessels navigating the river at high water was 14.5 feet. The mean rise and fall of the tide was about 6.5 feet at the city of Savannah, and 7 feet at the mouth of the river.

PLAN OF IMPROVEMENT.

The plan of improvement under which operations have been carried on during the last fiscal year provides for the establishment of a channel depth of 26 feet at mean high water from the city of Savannah to the sea. The mean rise and fall of tide varies from 6.75 feet at Fort Pulaski to 5.97 feet at the barge office in the city of Savannah. The principal features of the project of improvement, which is printed as a part of Appendix O 1, Annual Report of the Chief of Engineers for 1890, are:

(1) The enlargement of Drakie Cut.

(2) The entire or partial removal of King Island.

(3) The construction of a deflecting jetty from Argyle Island.

(4) The partial removal of Marsh Island and the closing of the channel north of it.

(5) The construction of a training wall from Marsh Island to Kinsey Point and the enlargement of the river near there.

(6) The construction of a training wall at Garden Bank.

(7) Spur jetties or bank protection in the Wrecks Channel and a deflecting jetty at Mackay Point.

(8) The removal of a portion of Dam No. 15.

(9) The closing of Duck Puddle.

(10) The construction of shore protection and of training walls between the wing dams in North Channel from the Upper Flats to the Oyster Bed.

(11) The construction of training walls, extending eastward from Cockspur Island and the Oyster Bed.

(12) Dredging is provided for between the Cross Tides and the Tybee Roads.

The estimated cost of this improvement is $3,500,000, provided funds are regularly and adequately supplied.

Prior to 1826 an expenditure of about $100,000, raised by a tax upon shipping entering the harbor, was made under the direction of the commissioners of pilotage in clearing the river of wrecks and in otherwise improving its condition; and between 1867 and 1871 an expenditure of $157,000 was made by the city of Savannah in dredging on the shoals between Cross Tides and the sea. From 1826, the date of the first appropriation made by the United States for the river, up to the date of beginning operations according to the 26-foot plan of improvement, appropriations aggregating $1,879,096.64 were made by Congress for the work.

Since then, under the new 26-foot plan of improvement, appropriations have been made aggregating $1,668,750. Among these there was one of $318,750, made in the river and harbor act approved July 13, 1892, and containing the following provision:

> *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the present project of improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two million eight hundred and thirty-one thousand two hundred and fifty dollars exclusive of the amount herein and heretofore appropriated.

In accordance with this proviso a contract was entered into on October 20, 1892, with P. Sanford Ross, of Jersey City, N. J., for all of the dredging, and on October 22, 1892, with the Atlantic Contracting Company, of New York, for all of the other work required for the improvement of the harbor.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

In 1872 the U. S. Engineer Department resumed charge of the improvement of the harbor. From that time up to July 1, 1874, there were removed from the channel 6 vessels, 16 cribs, and 1 sunken lighter, besides 166,498 cubic yards of material dredged at various places. From July 1, 1874, to July 1, 1890, operations were carried on in accordance with the 22-foot plan of improvement, a summary of which is given on p. 1246 of the Annual Report of the Chief of Engineers for 1890. A detailed history of the work done during this period will be found in the reports of the Chief of Engineers for 1888 and subsequent years.

Up to July 1, 1890, the total expenditures on Savannah Harbor by the United States, since 1826, including outstanding liabilities, amounted to $1,875,219.03.

Under the present project, which was approved by the Secretary of War July 22, 1890, the following work was accomplished prior to July 1, 1893: The Oyster Bed training wall was extended 1,984.1 feet, making its total length 12,016.1 feet. In addition to the stone used in sinking the mattresses the crest of the training wall was heavily loaded with riprap stone, being brought up to mean low water for a distance of 7,000 feet. There were used 72,178.4 square yards of log and brush mattresses and 26,844.27 cubic yards of riprap stone.

For the protection of caving banks there were built at Elba Island 17 spur dams of piles and brush, aggregating 1,248.2 feet in length, and at Jones Island 31 similar dams aggregating 3,625.8 feet in length. There were used in these dams 1,372 piles, 22,969.63 cubic yards of brush fascines, 125 square yards of brush mattresses, 1,033.98 cubic yards of stone, and 56,818.5 feet, B. M., sawed 6 by 10 inch timber, for the fastening of which to the pile work 6,602.84 pounds of iron bolts were used. Aside from the pile work proper there were driven 50 clusters of fender piles and 1 group of tie piles.

In the closing dam at Duck Puddle, 532 feet in length, there were used 275 piles, 6,977.23 cubic yards of brush fascines, and 778.39 cubic yards of stone.

In the South Elba Island training wall there were used 1,295 piles, 25,642.74 cubic yards of brush fascines, 26,706.59 square yards of brush mattresses, 1,479.89 cubic yards of stone, and 76,548 feet, B. M., of 6 by 10 inch sawed timber, as waling, cross and back ties, for the fastening of which 9,316.15 pounds of iron bolts were used. There were also driven 86 groups of tie piles.

In the North Elba Island training wall there were used 2,902 piles, 62,064.45 cubic yards of brush faucines, 39,355.34 square yards of brush mattresses, 2,419.27 cubic yards of stone and 168,661.10 feet, B. M., of 6 by 10-inch timber, as waling, cross and back ties, for the fastening which to the pile work 17,480.11 pounds of iron bolts were used. There were also driven 181 groups of tie piles and 1 cluster of fender piles.

There were put into the Lower Flats training wall 829.18 cubic yards of brush fascines, 174,522.02 square yards of brush mattresses, and 5,082.34 cubic yards of riprap stone.

Altogether there were, therefore, put into the various works up to

July 1, 1893, 118,483.23 cubic yards of brush fascines, 312,887.35 square yards of brush mattresses, 37,638.14 cubic yards of riprap stone, 302,027.6 feet, B. M., of 6 by 10 inch sawed timber, 33,399.10 pounds of iron bolts, 5,844 piles, and, aside from those, 268 groups of tie piles and 51 clusters of fender piles.

There were removed by dredging at various times from the various shoals between the Ocean Steamship Company's wharves and Tybee Knoll 920,833.84 cubic yards of material.

The total expenditures under the present project up to July 1, 1893, including outstanding liabilities, amounted to $827,669.48.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

Jetty work, under contract with the Atlantic Contracting Company, was continued during the fiscal year.

There were driven in the Marsh Island training wall 1,837 piles, advancing the same 7,212 linear feet. There were put into this training wall 26,676.66 square yards of brush mattresses, 32,480.35 cubic yards of brush fascines, 3,127.80 cubic yards of riprap stone, and 105,768 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 12,202.48 pounds of iron bolts were used. There were also driven 60 groups of tie piles and 1 cluster of fender piles, making in all 1,960 piles driven on this trainingl wall.

There were put into the Marsh Island closing dam 11,672.54 square yards of brush mattresses, 4,493.22 cubic yards of brush fascines, and 2,068.31 cubic yards of riprap stone.

There were driven in the Garden Bank training wall 814 piles, making a total length of pile work of 3,241 linear feet. There were put into this training wall 1,377.02 cubic yards of brush fascines, 51.27 cubic yards of riprap stone, and 26,821 feet, B. M., of 6 by 10 inch timber, as waling, cross and back nies, for the fastening of which 2,817.45 pounds of iron bolts were used.t There were also driven 12 clusters of fender piles, making in all 850 piles driven on this training wall.

In repairing Fig Island jetty 321.24 cubic yards of riprap stone were used.

There were used in the Mackay Point training wall 52,493.28 square yards of brush mattresses, 2,485.90 cubic yards of brush fascines, and 2,852.23 cubic yards of riprap stone. There were also driven 1 cluster of fender piles and 20 piles as guides, the latter of which are equivalent to 80 feet of pile work.

There were driven on the South Channel training wall and spur dams 389 piles, making a total length of 1,500 linear feet of pile work. There were put into these works 3,085 square yards of brush mattresses, 4,605.16 cubic yards of brush fascines, 290.28 cubic yards of riprap stone, and 12,713.50 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 936.65 pounds of iron bolts were used. There were also driven 29 groups of tie piles and 4 clusters of fender piles, making a total of 459 piles driven in these works.

There were driven on Barnwell Island closing dam No. 1, 68 piles, making a total length of 266 linear feet of pile work. There were put into this dam 930 square yards of brush mattresses, 1,040.30 cubic yards of brush fascines, 88.18 cubic yards of riprap stone, and 2,830 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 15.92 pounds of iron bolts were used. There were also driven 4 groups of tie piles, making in all 76 piles driven on this dam.

There were driven on Barnwell Island closing dam No. 2, 222 piles, making a total length of 870.5 linear feet of pile work. There were put nto this dam 5,571.56 cubic yards of brush mattresses, 832.52 cubic ards of riprap stone, and 17,571 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 544.91 pounds of ron bolts were used.

There were driven on Barnwell Island closing dam No. 3, 106 piles, making a total length of 424 linear feet of pile work. There were put nto this dam 3,622.49 cubic yards of brush fascines, 481.39 cubic yards f riprap stone, and 639 feet, B. M., of 6 by 10 inch timber, as waling, ross and back ties.

There were driven in the Barnwell Island training wall 769 piles, making a total length of 3,015 linear feet of pile work. There were put nto this wall 18,685 square yards of brush mattresses, 11,312.26 cubic ards of brush fascines, 991.13 cubic yards of riprap stone, and 36,531 eet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the astening of which 3,975.12 pounds of iron bolts were used. There were lso driven in this training wall 83 groups of tie piles and 3 clusters of ender piles, making a total of 935 piles.

There were driven on the Barnwell Island spur dams 125 piles, making a total of 474.5 linear feet of pile work. There were put into these dams 2,670 square yards of brush mattrasses, 1,728.01 cubic yards of brush fascines, 246.12 cubic yards of riprap stone, and 9,277 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 755.42 pounds of iron bolts were used. There were also driven n these spur dams 104 groups of tie piles and 2 clusters of fender piles, making a total of 339 piles.

There were put into the North Elba Island training wall 4,934.26 cubic yards of brush fascines, 228.63 cubic yards of riprap stone, and 1,524 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 634.39 pounds of iron bolts were used.

In repairing the South Elba Island training wall 67.07 cubic yards of riprap stone were used.

In repairing Wing Dam No. 14 263.88 cubic yards of riprap stone were used.

In repairing Philbricks Cut dam 132.92 cubic yards of riprap stone were used.

There were put into the South Flats training wall 10,041.11 square yards of brush mattresses and 2,257·88 cubic yards of riprap stone.

There were driven in the Venus Point training wall 1,834 piles, making a total length of 7,391 linear feet of pile work. There were put into this training wall 29,720.56 square yards of brush mattresses, 21,874.01 cubic yards of brush fascines, 2,234.76 cubic yards of riprap stone, and 101,265.5 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 11,024.92 pounds of iron bolts were used. There were also driven 161 groups of tie piles, making a total of 2,156 piles driven in this training wall.

In repairing the dams across Big Gap there were used 25 cubic yards of riprap stone.

In repairing and strengthening the Jones Island spur dams there were used 864.40 cubic yards of brush fascines, and 1,608 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, for the fastening of which 246.02 pounds of iron bolts were used.

In repairing Wing Dam No. 33 there were used 99.15 cubic yards of riprap stone.

There were put into the Long Island training wall 303,605.59 square yards of brush mattresses, 857.17 cubic yards of brush fascines, and

20,086.78 cubic yards of riprap stone. There were also driven 375 piles as guides, which are an equivalent of 1,500 linear feet of pile work.

In repairing and raising the crest of the Oyster Bed training wall there were used 3,953.23 cubic yards of riprap stone.

There were put into the Cockspur Island training wall 239,956.91 square yards of brush mattresses, 1,946.72 cubic yards of brush fascines, and 16,942.87 cubic yards of riprap stone. There were also driven 202 piles to serve as guides, which are an equivalent of 808 linear feet of pile work.

Altogether there were, therefore, put into the various works during the fiscal year by the Atlantic Contracting Company:

Brush mattresses	square yards..	699,536.65
Brush fascines	cubic yards..	99,192.83
Riprap stone	...do....	57,633.63
6 by 10 inch sawed timber	feet, B. M..	325,299.00
Iron bolts	pounds..	33,153.28

There were driven 6,155 piles, making an aggregate advance of pile work of 24,576.1 linear feet; 597 piles were driven as guides for the mattress work, which are an equivalent of 2,388 linear feet of pile work, making a total of 26,964.1 linear feet of pile work appearing in the monthly reports and estimates of the fiscal year. There were also driven 441 groups of tie piles and 23 clusters of fender piles, making a total of 7,703 piles driven during the fiscal year.

Under special authority 5 barges were purchased in open market and sunk to close openings in Big Gap Dam and Philbricks Cut Dam.

Dredging work under contract of October 20, 1892, with P. Sanford Ross was continued throughout the fiscal year. The following quantities of material were removed at various points:

(1) In removing a part of Kings Island, 126,850.40 cubic yards;
(2) In removing a part of Marsh Island, 36,920.10 cubic yards;
(3) In Marsh Island Channel, 426,866.80 cubic yards;
(4) In Front River, 62,049.60 cubic yards;
(5) In Wrecks Channel, 63,682.00 cubic yards;
(6) At the Upper Flats, 51,576 cubic yards;
(7) At the Oyster Bed Shoals, 68,319.11 cubic yards; and
(8) At Tybee Knoll, 141,832.79 cubic yards, making in all 978,096.80 cubic yards of material removed during the year.

The snagboats *Toccoa* and *Satilla*, when not engaged on other work, and the steam hoister *Sapelo* were employed in the removal of old crib obstructions and of wing dams projecting into the channel beyond the line of improvement. There were removed from wing dams No. 13, No. 15, No. 25, from the Garden Bank wing dams, from the old wharf at Fort Oglethorpe, and from the crib obstructions at the head of South Channel and near Wing Dam No. 15, altogether 2,400 feet B. M. of sawed timber, 276¾ cubic yards of riprap stone, 3,401 logs, and 35 piles. This work was done by hired labor and purchase of material in open market.

Under authority granted March 30, 1894, by the Chief of Engineers, a steam hoister, for use on the rivers and in Savannah harbor, was constructed by hired labor and purchase of material in open market.

An examination of the channel throughout the harbor was made in February and March. A detailed survey of the entire river from Cross Tides to the sea, including Back River and South Channel, was commenced toward the end of March and is still in progress. Self-registering tide gauges have been established at Fort Pulaski, Fort Oglethorpe, and at the old waterworks.

The river was gauged near the mouth in July and August, 1893, and cial observations for direction and velocity of ebb and flood flow 'e madeat Tybee Knoll. The ebb and flood volumes passing through ıth Channel and Lazaretto Creek were also determined. The details ;his work will be found in the report of my assistant engineer, Mr. A. Gieseler, which is appended hereto (Appendix 1).

CONDITION OF WORK JUNE 30, 1894.

'he least practicable channel depth from the old water works down ·he Ocean Steamship Company's wharves, which formerly was only ·ut 6 feet at mean low water, has been increased by dredging, and by ur induced through the contraction of the river, to more than 13 :. It is expected that the favorable conditions of flow created ough the construction of the Marsh Island closing dam and the rsh Island training wall will make the channel there a permanent ·. From the Ocean Steamship Company's wharves through Front 'er and Wrecks Channel down to the deep water near Fort Oglerpe there is a least practicable channel depth of 16 feet at mean water. All of the works from Cross Tides to Fort Oglethorpe are ·ood condition; they are all completed, excepting the Garden Bank ining wall, which was nearly completed at the end of the fiscal year.

'rom Fort Oglethorpe down to the deep water below the Lower ts there is a least practicable channel depth of 16½ feet; on the per Flats there is now 19 feet. The construction of the Mackay nt, the South Channel, and the Barnwell Island works has increased volume at "Obstructions" and below, and greater stability of the ınnel is expected in future. All the works on this stretch are comted and in good condition.

'rom the Lower Flats to Oyster Bed Shoal there is a least practile channel depth of about 16 feet, and from Oyster Bed Shoal to l over the Knoll there is a minimum mean low-water depth of about 'eet. The completion of the Long Island training wall and the tial construction of the Cockspur Island training wall have already reased the flow over the Knoll, and a correspondingly greater staty of the channel appears to be noticeable already. All of the ·ks in this region are in good condition.

COMMERCE AND NAVIGATION.

ʟ full statement and discussion of the commerce of Savannah were en in my annual report for 1890, to which I respectfully refer for ails in this connection.

'he railroads now centering in Savannah are the Charleston and ·annah, the South Bound, the Central of Georgia, the Savannah, ıericus and Montgomery, the Savannah, Florida and Western, and Florida Central and Peninsular. The railroads under construction the Macon and Atlantic and the Macon and Dublin.

n addition to the railroads the Savannah River, navigable as far as gusta, a distance of 202 miles by the river, for boats drawing from) 5 feet, affords another means of communication with the interior, l many small steamers and sailing craft ply the waters of the inland te, along the adjacent coast, gathering the products of sea and of coast plantations for transshipment at Savannah.

'hese avenues of commerce bring to Savannah the cotton, lumber, ·al stores, and farm and mineral products of large portions of the tes of Georgia, South Carolina, Florida, Alabama, and Tennessee, as well as other classes of through freights from the West and west.

Regular lines of steamships have been established between this and Boston, New York, Philadelphia, and Baltimore. These lines prise a total of 12 steamships, of which 6 are to New York, 2 to 3 to Baltimore, and 1 to Philadelphia. They make yearly about voyages and carry about 630,000 tons of freight.

On the inland waters there are seven small steamers plying bet Savannah and adjacent ports, making annually from 500 to 600 trips, carrying about 67,000 tons of freight, valued at more than $4,000,0

The chief articles of export are cotton, lumber, and naval stores which the present annual shipments may be given in round numb as follows: Of cotton, 794,000 bales; of lumber, 77,461,000 feet, and naval stores, 256,889 barrels of turpentine and 915,623 barrels of

The total annual tonnage of the port, inward and outward bound more than 2,000,000 tons.

The prices obtained for cotton, lumber, and naval stores have so low and unsatisfactory during the past two years that the val the exports have decreased considerably.

Past improvement of the harbor has resulted in increasing available depth at high water from 14.5 to from 23 to 24 feet. increase in the value of exports since the year 1873, when the was begun, is proportional to the cube of the increase in the dep water during the same period. The annual saving in freight alone, due to the increased depth, amounts to more than the total of money expended by the United States upon the harbor. Rates marine insurance have also been reduced.

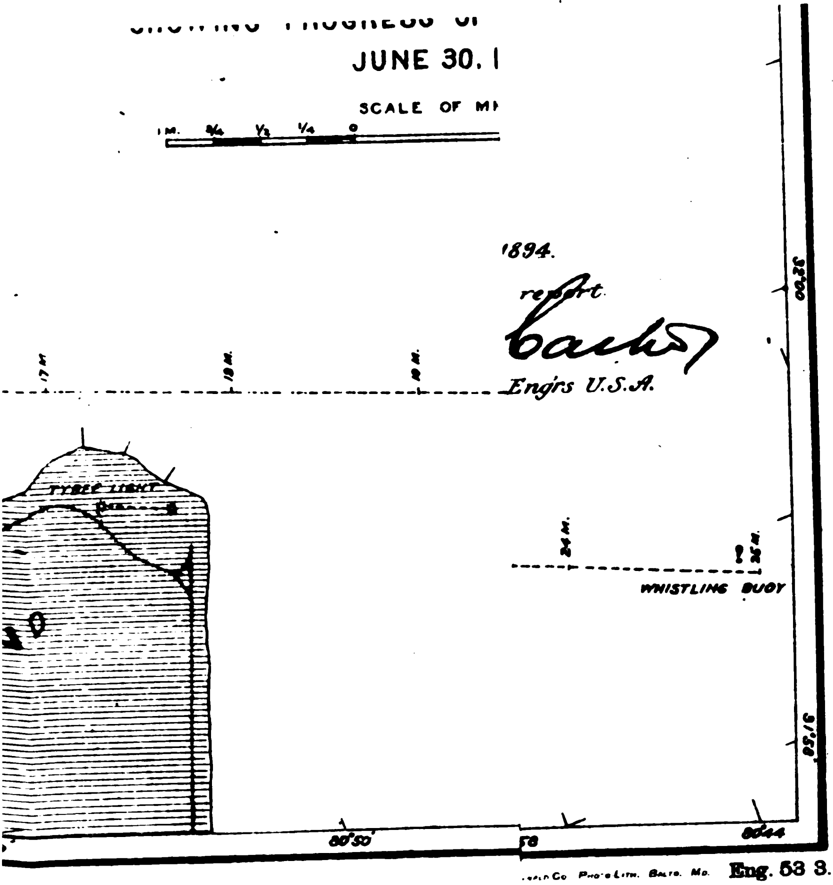
TABLE 1.—*Cotton receipts at Savannah from 1872 to 1894.*

Season, Aug. 31 to Sept. 1—	Bales.	Season, Aug. 31 to Sept. 1—	[illegible]
1872-'73	612,794	1883-'84	[illegible]
1873-'74	630,372	1884-'85	[illegible]
1874-'75	614,478	1885-'86	[illegible]
1875-'76	523,244	1886-'87	[illegible]
1876-'77	477,435	1887-'88	[illegible]
1877-'78	597,449	1888-'89	[illegible]
1878-'79	693,764	1889-'90	[illegible]
1879-'80	741,018	1890-'91	[illegible]
1880-'81	889,383	1891-'92	[illegible]
1881-'82	737,056	1892-'93	[illegible]
1882-'83	817,670		

TABLE 2.—*Steamship lines.*

Lines.	Savannah to—	Steamers.	Voyages.	[illegible]
Ocean Steamship Co	New York	6	179	[illegible]
New England and Savannah Steamship Co.*	Boston	2	51	[illegible]
Merchants' and Miners' Transportation Co	Baltimore	3	103	[illegible]
Ocean Steamship Co	Philadelphia	1	36	[illegible]
Total		12	[illegible]	[illegible]

*Controlled by Ocean Steamship Company.



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MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1892, $56,664.90. The nearest light-houses are those upon the river, and forts Oglethorpe and Pulaski are the nearest forts.

Since the existing project for improving Savannah Harbor was adopted, the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$4,035.05
September 19, 1890	350,000.00
July 13, 1892	318,750.00
March 3, 1893	1,000,000.00
Total	1,672,785.05

In accordance with the provisions of the river and harbor act of July 13, 1892, contracts have been entered into for the execution of all of the work necessary to complete the present project of improvement.

The sum asked for during the next fiscal year is $1,831,250. It is important that operations in Savannah Harbor should not be suspended, and the most desirable and satisfactory results can not be obtained with an expenditure during the year of a less amount.

The total expenditures under the present project to June 30, 1894, including all outstanding liabilities, were $2,076,549.63.

Money statement.

July 1, 1893, balance unexpended		$1,000,102.20
June 30, 1894, amount expended during fiscal year		750,102.20
July 1, 1894, balance unexpended		250,000.00
July 1, 1894, outstanding liabilities	$653,864.58	
July 1, 1894, amount covered by uncompleted contracts	408,034.40	
		245,830.18
July 1, 1894, balance available:		
For contingencies		4,169.82
For contract work		408,034.40
Amount (estimated) required for completion of existing project		1,831,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		1,831,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

GAUGING AT AND NEAR THE MOUTH OF SAVANNAH RIVER, GEORGIA.

INDEX.

Page.
Instructions 1138
1. Tidal work 1138
    Revision of tidal data 1138
    Table 1. Tidal data of the Lower Savannah River 1139
    Ratio of decrease of height of tidal wave 1139
    Table 2. Simultaneous observations of height 1140
    Table 3. Corresponding heights of high and low water 1141
2. Current observations generally 1141
    Rating of meters 1141
    Assistants 1141
    Method of field work 1141

GAUGING AT AND NEAR THE MOUTH OF SAVANNAH RIVER, GEORGIA—continued.

INDEX—Continued.

Page.
3. Ebb and flood volumes gauged 1142
  Methods of computation 1142
  Tidal observations 1142
  Lines gauged 1142
  Volumes as corrected to mean tide 1142
  Fresh water flow 1142
  Table 4. Rainfall and discharge at Augusta 1142
  The mean fresh water flow 1143
  Gauge readings and discharge at Augusta 1143
  Observations at Augusta during gauging 1143
  Correction for fresh water flow 1144
  Table 5. True mean volumes of 1893 1144
4. Checking the present and former results 1144
  Fresh water correction for work of 1890 1144
  Table 6. True mean volumes of 1890 1145
  Table 7. True mean volumes near mouth, 1890-1893 1145
  Fresh water correction for work of 1889 1146
  Table 8. True mean volumes of 1889 1146
  Table 9. True mean volumes near mouth, 1889 1146
  Summary of checks 1147
  Uncertainty of fresh water corrections 1147
5. Summary of results for the region of mouth 1148
  Table 10. True mean volumes 1148
  Table 11. Mean fresh water flow of river 1148
  Table 12. Tidal volumes under various conditions of fresh water flow 1149
  Table 13. Tidal volumes under various conditions of fresh water flow 1149
  Table 14. Tidal volumes under various conditions of fresh water flow 1149
  Frequency of freshets 1150
  Table 15. Tidal volumes under various conditions of tide 1150
  Table 16. Tidal volumes under various conditions of tide 1150
  Table 17. Tidal volumes under various conditions of tide 1151
  Frequency of high tides 1151
  Lack of uniformity of fresh water flow 1151
  Conclusions 1151

APPENDIX 1.

REPORT OF MR. E. A. GIESELER, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., March 9, 1894.

CAPTAIN: I have the honor to report as follows upon additional gauging work done in the mouth of the Savannah River. It was intended by means of this work to investigate the conditions of flow in the outer part of the entrance with a view of arriving at a final decision in regard to the location of works of contraction there. In accordance with this I received from you the following verbal instructions:

"To gauge for direction and velocity on a line drawn from about the outer end of the Oyster Bed training wall to Tybee Light, and, again, on another line somewhat farther out. On both lines particular attention was to be paid to the region near the present channel and to that near the Long Island range.

"To complete the current work of 1889 and 1890 by gauging South Channel and Lazaretto Creek near the mouth.

"To do all necessary tidal work."

1. TIDAL WORK.

It appears proper first to report here upon some tidal work which has been done in completion of what was reported upon under date of January 31, 1890.

The tidal results rendered then were based upon four months' continuous observations at certain standard gauges. At two of these, viz, Fort Pulaski and Fort Oglethorpe, observations were subsequently continued and a full year's record was obtained at each and made the basis of a revision of the tidal data at all points. The results obtained in this way are rendered in the following table:

TABLE 1.—*Tidal data on the Lower Savannah River.*

NORTH CHANNEL AND FRONT RIVER.

No.	Name of station.	Distance from Tybee.	Mean lunitidal interval of—		Mean duration of—		Elevation above Fort Pulaski, mean low water.		Mean rise and fall.
			H. W.	L. W.	Fall.	Rise.	H. W.	L. W.	
		Stat. miles.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*Feet.*	*Feet.*	*Feet.*
1	Tybee Island (Coast Survey)	0.0	7 15	13 28	6 13	6 12	6.75	0.00	6.75
2	Fort Pulaski	2.5	7 17	13 56	6 39	5 46	6.75	0.00	6.75
3	Venus Point	6.2	7 32	14 22	6 50	5 35	6.95	0.20	6.75
4	Lower Elba Island	8.1	7 42	14 39	6 57	5 28	6.97	0.30	6.67
5	Spirit Island	10.3	7 47	14 55	7 08	5 17	7.00	0.42	6.58
6	Obstructions	11.7	7 56	15 02	7 06	5 19	7.06	0.50	6.56
7	Fort Oglethorpe	13.1	8 06	15 13	7 07	5 18	7.05	0.59	6.46
8	Savannah, Florida and Western Railway pier	14.7	8 08	15 23	7 15	5 10	7.19	0.97	6.22
9	Barge Office	16.0	8 15	15 36	7 21	5 04	7.13	1.16	5.97
10	Central Railroad	18.1	8 24	15 58	7 34	4 51	7.23	1.92	5.31
11	Reads Mill	19.2	8 30	16 13	7 43	4 42	7.18	2.34	4.84
12	Cross Tides, upper	20.7	8 37	16 29	7 52	4 33	7.20	2.75	4.45
13	Purysburg	39.2	11 28	19 34	8 06	4 19	10.68	10.08	0.60

SOUTH CHANNEL AND BACK RIVER.

1	Light-House Wharf	0.0	7 20	14 00	6 40	5 45	6.75	0.00	6.75
2	St. Augustine Creek	7.5	7 52	14 47	6 55	5 30	7.01	0.34	6.67
3	Fort Oglethorpe	10.0	8 06	15 13	7 07	5 18	7.05	0.59	6.46
4	Cross Tides, lower	17.0	8 32	16 02	7 30	4 55	7.26	0.88	6.38
5	Recess	18.0	8 34	16 18	7 44	4 41	7.13	1.27	5.86

The tidal observations made at Fort Pulaski, Fort Oglethorpe, Barge Office, and Cross Tides in 1889 and 1890 were also utilized to determine the ratio of decrease of the tidal wave moving in the Savannah River during its upward course. The ratio is different for different heights of tide (being smaller for low tidal waves and being greater for higher ones) and its knowledge is of practical importance, as it affords the most simple method of recognizing changes in the tidal status of the river, brought about by changes made in its bed. For the purpose stated the simultaneous observations of high and low-water readings at each pair of adjacent gauges were grouped according to their height, from half foot to half foot. The figures thus obtained for each gauge were averaged and their averages or means are rendered in Table No. 2. By them the above-mentioned ratio is expressed in this way, that they show what height of high or low water at an upper point corresponded to a given height at the adjacent lower point at the time the observations were made, that is, from May, 1889, to May, 1890.

In order to render these results in a form more convenient for reference, they were reduced by a simple process of interpolation to even readings on the Fort Pulaski gauge, and the figures thus found are submitted in Table No. 3 and also in a diagram accompanying this report (Sheet No. 1, lines of high and low water for various elevations of high and low water). These figures, then, are a faithful representation of the tidal status of the river in 1889 and 1890 and, therefore, form a reliable basis for a comparison between it and the tidal status at any later period. At the time of this writing self-registering tide gauges have been established at Fort Pulaski and at Fort Oglethorpe, the records of which will within a short time afford the possibility of such a comparison and thus demonstrate what influence the contraction of the river has had on its tidal status so far.

TABLE 2.—***Means of heights of high and low waters observed 1889 and 1890 simult***
ously at the standard gauges, Savannah Harbor, and arranged in groups of about e
height.

[All heights refer to mean low water at Fort Pulaski.]

A.—FORT PULASKI—FORT OGLETHORPE.

High water.			Low water.		
Number of observations.	Mean of observed heights at—		Number of observations.	Mean of observed heights at—	
	Fort Pulaski.	Fort Oglethorpe.		Fort Pulaski.	Fort Oglethorpe.
21	4.86	5.17	42	—1.57	—0.43
54	5.51	5.84	67	—1.05	—0.08
88	5.98	6.31	130	—0.49	0 21
144	6.46	6.79	158	—0.03	0.57
146	6.93	7.22	136	0.42	0.85
112	7.45	7.72	53	0.94	1.27
48	7.87	8.12	37	1.45	1.70
19	8.37	8.56	13	2.23	2.36

B.—FORT OGLETHORPE—BARGE OFFICE.

High water.			Low water.		
Number of observations.	Mean of observed heights at—		Number of observations.	Mean of observed heights at—	
	Fort Oglethorpe.	Barge Office.		Fort Oglethorpe.	Barge Office.
6	5.47	5.63	12	—0.46	0.21
32	5.88	6.02	52	—0.06	0.58
39	6.45	6.56	69	0.30	0.97
58	6.92	7.01	45	0.82	1.33
43	7.32	7.40	13	1.35	1.82
18	7.80	7.93	4	1.95	2.41
12	8.44	8.47	....	....	....
4	8.77	8.78	....	....	....

C.—BARGE OFFICE—CROSS TIDES.

High water.			Low water.		
Number of observations.	Mean of observed heights at—		Number of observations.	Mean of observed heights at—	
	Barge Office.	Cross Tides.		Barge Office.	Cross Tides.
6	5.69	5.81	18	0.22	1.88
38	6.06	6.20	63	0.64	2.30
45	6.64	6.74	77	1.10	2.65
47	7.11	7.17	31	1.53	2.96
25	7.50	7.54	10	2.23	3.55
16	8.04	8.01	....	....	....
12	8.53	8.44	....	....	....

TABLE 3.—*Corresponding heights of high and low water in Savannah River, Georgia.*

[All heights refer to mean low water at Fort Pulaski.]

High water.				Low water.			
Pulaski.	Ogle-thorpe.	Barge Office.	Cross tides.	Pulaski.	Ogle-thorpe.	Barge Office.	Cross tides.
4.5	4.92	5.10	5.32	—1.6	—0.46	0.21	1.94
5.0	5.39	5.55	5.74	—1.4	—0.34	0.30	2.01
5.5	5.85	5.99	6.16	—1.2	—0.22	0.41	2.10
6.0	6.34	6.46	6.58	—1.0	—0.09	0.52	2.20
6.5	6.82	6.92	7.00	—0.8	0.03	0.63	2.29
7.0	7.30	7.38	7.42	—0.6	0.16	0.75	2.38
7.5	7.77	7.83	7.84	—0.4	0.29	0.87	2.47
8.0	8.25	8.29	8.26	—0.2	0.42	0.99	2.56
8.5	8.73	8.75	8.68	0.0	0.56	1.12	2.66
				0.2	0.71	1.25	2.77
				0.4	0.86	1.38	2.88
				0.6	1.01	1.51	2.99
				0.8	1.16	1.65	3.10
				1.0	1.32	1.80	3.21
				1.2	1.48	1.94	3.32
				1.4	1.65	2.09	3 43
				1.6	1.82	2.24	3.55
				1.8	1.99	2.39	3.67
				2.0	2.16	2.55	3.80
				2.2	2.34	2.71	3.93
				2.4	2.53	2.87	4.05

2. CURRENT OBSERVATIONS GENERALLY.

In order to secure a rapid execution of the field work, it was decided to work multaneously with five meters. All available instruments were therefore put into ndition and rated by me with the following results:

	a.	b.
opeller meter No. I	1.74	0.06
opeller meter No. II	2.18	0.13
opeller meter No. III	1.48	0.12
ff and Berger, Savannah No. 1	3.68	0.14
ff and Berger, Savannah No. 2	3.72	0.11
ff and Berger, St. Augustine No. 1	3.76	0.09
is meter A	3.57	0.01

The following gentlemen were designated by you to assist me: Messrs. S. M. Hale, rion Twiggs, R. F. Ensey, W. G. Austin, and J. B. Connolly. With the exception Mr. Hale, none of them had any previous experience in electric current meter rk, a circumstance which naturally caused much difficulty and delay in the early ges of the work and the disadvantages of which has at no time been entirely ercome.

The methods employed were essentially the same as those described in my report January 31, 1890, with the exception that the use of a standing line was dispensed th, the meter simply being suspended from the end of the copper chain and not ld in any other way. The motive of this change was a twofold one. In the first ce, it was desirable in an exposed place like Tybee roadstead to simplify and orten as much as possible the operation of taking in the meter as it might possibly ve to be performed quickly under suddenly arising unfavorable circumstances. the second place, the new method did away with the difficulty (always experi- ced when using a standing line) of getting the meter down to the lower strata in trong current.

The directions were to be determined by the observation with sextants of pole ats, with one of which every boat was provided.

Five boats having been fitted out in the usual way with spring planks, anchors, es, etc., and all other necessary material having been provided, on the 24th of ly this and the party were taken down to Fort Pulaski, where quarters had been pared, and on the morning of the 25th work was commenced and continued until gust 2. The weather during this time was not very favorable; a few calm morn- gs were fortunately obtained for the outside gauging, but during the rest of the time and especially in the afternoon hours work was very much interfered with by squally and rainy weather. I now proceed to submit the results obtained.

3. EBB AND FLOOD VOLUMES GAUGED.

The methods of computation were the same as those employed and described in former reports. Sixteen sheets of velocity diagrams and two sheets of tidal diagrams in which are embodied the entire field results, are submitted herewith. In regard to the tidal observations, it should be mentioned that staff gauges were established in South Channel and in Lazaretto Creek and were observed in the usual way during the gauging in those localities. The two outer lines were referred to a gauge nailed to a pile in deep water off Tybee Point. The self-registering tide gauge at Fort Pulaski was kept running during the entire time of work and from it, as a standard gauge, mean conditions at the other gauges were determined. The location of the gauged lines is given on the appended diagram, No. 2, where they are designated as follows:

1. Line L at Bell Buoy.
2. Line M at Buoy No. 2.
3. Line N near mouth of South Channel.
4. Line O near mouth of Lazaretto Creek.

The two last lines are situated within a short distance from the respective mouth, the inclosed tidal prism being in the case of South Channel 22.4 million cubic feet, and in the case of Lazaretto Creek 5.4 million cubic feet. Through the addition of these amounts to the volume found, discharge and inflow at the mouth was obtained in both cases and these are the figures rendered below.

A correction for tides was required only in the case of the outer lines, while during the gauging of South Channel and Lazaretto Creek the rise and fall was so near the mean range that the figures were left unchanged. The ebb and flood volumes corresponding to mean tidal conditions are as follows:

Locality.	Ebb volume.	Flood volume.
	Cubic feet.	*Cubic feet.*
Mouth of South Channel	705,300,000	552,[illegible]
Mouth of Lazaretto Creek	112,000,000	92,4[illegible]
At line L (Bell Buoy)	2,974,600,000	Not obtained.

We now have to consider the important subject of fresh-water flow, which has been studied more thoroughly than was possible heretofore. By means of the relations established by Mr. G. W. Brown between the height of the river and its discharge, I have computed from the daily readings of the river gauge at Augusta the daily discharges there for a period of five years, the annual means of which computation are rendered in Table 4.

TABLE 4.—*Rainfall and discharge at Augusta, Ga.*

Year.	Rainfall.	Mean discharge per second.	Coefficient of efflux.	Mean gauge reading.
	Inches.	*Cubic feet.*		
1889	49.79	12,750	0.48	[illegible]
1890	43.00	8,770	0.36	[illegible]
1891	48.16	14,160	0.54	[illegible]
1892	39.32	12,700	0.60	[illegible]
1893	47.54	8,760	0.34	[illegible]
Mean	45.54	11,430	0.47	[illegible]

The mean annual rainfall at Savannah has been found at 51.7 inches from a series of twenty-three years (1871–1893). For Augusta, a series of fourteen years only was available (1880–1893), from which an annual mean of 46 inches was deduced. During the same period the annual mean at Savannah was about 49 inches, that is 3 inches less than the mean found from the longer series. The indications, therefore, are that the final means of Table 4 of annual rainfall and discharge per second are somewhat too small. Still a correction of the latter has not been attempted on account of the lack of data on which to base it.

If now the mean annual precipitation of the entire river valley is assumed at [illegible] inches and its mean area at 10,500 square miles, then we have a precipitation of

38,700 cubic feet per second. The coefficient of efflux at the mouth must necessarily be smaller than the one for Augusta, viz., 0.47. The value of 0.40, which is quite consistent with the results of Table 4 and which agrees essentially, as will be seen later on, with the result of our current observations, renders an average fresh-water flow at Savannah of 15,480 cubic feet per second.

The determination of the fresh-water state of the river has been done as before by means of the Augusta gauge readings, according to the following table obtained from Mr. Brown's discharge measurements at Augusta:

Gauge readings and corresponding discharge at Augusta.

Reading of gauge at Augusta.	Corresponding discharge per second.
	Cubic feet.
6.0	3,900
6.5	4,500
7.0	5,200
7.5	5,900
8.0	6,600
8.5	7,500
9.0	8,400
9.5	9,400

The time required for the propagation of a given condition of the river from Augusta to the tidal portion has been assumed at eight days, and while this figure is probably a very good average, a study of the seven months' simultaneous observations at Augusta and Purysburg, submitted herewith, reveals the fact that small freshets occuring during a low river are propagated faster. The Augusta record during and immediately preceding the present current work was as follows:

July 1—

20	Varying between 5.2 and 6.8
21	7.6
22	12.5
23	13.3
24	11.0
25	8.1
26 (gauged line, Buoy No. 2)	6.3
27 (gauged line, Bell Buoy)	6.2
28	6.2
29	6.2
30	6.0
31 (gauged line, South Channel)	5.0

The sudden occurrence of a small and short freshet during an otherwise comparatively uniform period makes the determination of the fresh-water state of the river during the gauging of the lines M (Buoy No. 2) and L (Bell Buoy) a matter of some uncertainty, which might be removed in the case of future current work by the establishment of a gauge at Purysburg.

In view of what has been said above on the time of propagation of small freshets, the fresh-water flow at the mouth has been assumed as normal on the 26th and 27th of July, while on July 31 it has been assumed as corresponding to an Augusta reading of 6.2. The same assumption has been made for August 1, on which day the line Lazaretto Creek (line O) was gauged. At Augusta a discharge of 4,200 cubic feet corresponds to a gauge reading of 6.2 and the deficiency of fresh-water flow during the gauging of lines N and O therefore would be 11,400—4,200=7,200 cubic feet, if it were for the river valley above Augusta only. To properly consider the valley below this place we have, however, to add 25 per cent to the above figure, rendering for both lines a deficiency of fresh-water flow of 9,000 cubic feet per second.

In accordance with their size, as compared with the total river cross section, one-third of the entire deficiency should be applied to South Channel and one-twentieth to Lazaretto Creek; that is:

	Cubic feet per second.
South Channel	3,000
Lazaretto Creek	450

Now the mean duration of flow has been found as follows:

Mean duration of flow.

	Ebb.	Flood.
	h. m.	*h. m.*
Mouth of South Channel	7 02	5 [illegible]
Lazaretto Creek	6 35	5 [illegible]

And we therefore obtain the following corrections to be applied to the gauged volumes:

Corrections for fresh-water flow to be applied to the gauged volumes.

	Ebb correction.	Flood correction.
	Cubic feet.	*Cubic feet.*
Mouth of South Channel	+76,000,000	—56,100,000
Mouth of Lazaretto Creek	+10,700,000	— 9,500,000

Applying these corrections we obtain:

TABLE 5.—*True mean ebb and flood volumes as gauged, 1893.*

Locality.	Ebb.	Flood.
	Cubic feet.	*Cubic feet.*
Mouth of South Channel (at Lazaretto Creek)	781,300,000	48[illegible]
Mouth of Lazaretto Creek	122,700,000	82,[illegible]
At line L (bell buoy)	2,974,600,000	Not obtained.

4. CHECKING THE PRESENT AND FORMER RESULTS.

For the volumes found in 1890 (Chief of Engineer's Report for 1890, p. 1299) we have, according to our present data, the following fresh-water correction:

Locality.	Gauge-reading at Augusta.	Deficiency per second.	
		At Augusta.	At the mouth.
		Cubic feet.	*Cubic feet.*
Line H	8.5	3,900	4,[illegible]
Line I	7.5	5,500	6,[illegible]
Line K	7.2	5,900	7,[illegible]

In accordance with the relative size of channel the percentage of the full deficiency of fresh-water flow to be applied in each case is as follows:

Line H, two-thirds of deficiency to be applied.
Line I, one-half of deficiency to be applied.
Line K, one-tenth of deficiency to be applied.

The mean duration of flow at those places is as follows (Tables F, appended to Report of 1890):

	Mean duration of flow.	
	Ebb.	Flood.
	h. m.	*h. m.*
Line H	6 25	6 [illegible]
Line I	6 35	5 [illegible]
Line K	6 12	6 [illegible]

And we therefore obtain the following corrections to be applied to the gauged volumes:

	Ebb correction.	Flood correction.
	Cubic feet.	*Cubic feet.*
Line H	+75,000,000	—70,200,000
Line I	+81,500,000	—72,200,000
Line K	+16,500,000	—16,600,000

If these corrections are applied and if a tidal prism of 80,000,000 cubic feet is added to the volumes found at line H, in order to obtain the flow at the mouth of the North Channel, 800 feet below Wing Dam 35, then we have:

TABLE 6.—*True mean volumes of tidal flow gauged, 1890.*

Locality.	Ebb.	Flood.
	Cubic feet.	*Cubic feet.*
Mouth of North Channel, 800 feet below Wing Dam 35	1,784,800,000	1,420,500,000
At line I	1,473,600,000	976,400,000
At line K, Wrights River	804,500,000	804,800,000

From the figures of tables 5 and 6 the entire discharge of Savannah River proper, at a line drawn immediately above Lazaretto Creek across South Channel and immediately above Wrights River across North Channel, is found as follows:

TABLE 7.—*True mean tidal volumes at mouth of Savannah River.*

Locality.	Ebb.	Flood.
	Cubic feet.	*Cubic feet.*
At mouth of South Channel, gauged 1893	781,300,000	493,900,000
At mouth of North Channel, gauged 1890	1,784,800,000	1,420,500,000
Entire river	2,566,100,000	1,914,400,000

For the volumes found in 1889 (Chief of Engineer's Report for 1890, p. 1278) we have, according to our present data, the following figures for fresh-water correction:

Locality.	Gauge-reading at Augusta.	Deficiency per second.	
		At Augusta.	At the mouth.
		Cubic feet.	*Cubic feet.*
Line F, North Channel	8.0	4,800	6,000
Line D, South Channel	9.2	2,600	3,250
Line G, Duck Puddle	8.5	3,900	4,875
Line E, St. Augustine Creek	9.0	3,000	3,750

In accordance with the relative size of the various channels the percentage of the full deficiency of fresh-water flow to be applied in each case is as follows (line G on account of its insignificance having been left out):

Line F, one half of the full deficiency to be applied.
Line D, one-third of the full deficiency to be applied.
Line E, one-sixth of the full deficiency to be applied.

The mean duration of flow at the various places is as follows (Tables B, appended to Report of 1890):

	Ebb.	Flood.
	h. m.	*h. m.*
Duration of flow at line F	7 07	5 18
Duration of flow at line D	7 18	5 07
Duration of flow at line E	6 20	6 05

And we therefore obtain the following corrections to be applied to the gauged vol umes, in order to reduce them to mean conditions of fresh-water flow:

	Ebb correction.	Flood correc tion.
	Cubic feet.	*Cubic feet.*
Line F	+76,900,000	−57,[illegible]
Line D	+28,900,000	−[illegible]
Line E	+14,200,000	−13,[illegible]

The application of these corrections to the volumes **at the head of p. 1278, Repor of 1890,** renders the following volumes **corresponding to mean conditions of tides an** fresh-water flow:

TABLE 8.—*True mean volumes of tidal-flow gauges, 1889.*

Locality.	Ebb volume.	Flood volu
	Cubic feet.	*Cubic feet.*
Line F, North Channel	1,100,000,000	675,[illegible]
Line D, South Channel	777,600,000	407,[illegible]
Line G, Duck Puddle	73,700,000	87,[illegible]
Line E, St. Augustine Creek	350,700,000	275,[illegible]

In the Report of 1890 (pp. 1300, 1301) **the volumes found for the mouth of Nor** Channel are compared with those found in 1889 **for an upper point of North Chann** But the value of the check thus obtained is **dependent on the closeness with whi** the unknown flow through the "Gaps" has **been estimated. By the present gau** ing of South Channel, however, a direct comparison **is made possible between t** volumes discharged at the mouth and those **discharged at upper points. For th** purpose it is necessary first to deduce from **the figures of Table 8 the volumes of fl** in South Channel below St. Augustine Creek. **(See Report of 1890, pp. 1287, 128**

THE FLOW IN SOUTH CHANNEL BELOW **ST. AUGUSTINE CREEK.**

1. EBB.

	Cubic fee
Ebb outflow at line D	777,600,(
(*e*+*f*) for St. Augustine Creek	+46,000,(
	823,600.(
Ebb outflow through St. Augustine Creek	350,700,(
Consequently, ebb flow in South Channel **below St. Augustine** Creek	472,900,(

2. FLOOD.

	Cubic fee
Flood inflow at line D	407,900,
(*e*+*f*) for St. Augustine Creek	+46,000,
	453,900.
Flood inflow through St. Augustine Creek	275,000,
Consequently, flood flow in South Channel **below St. Augustine** Creek	178,900,

From these figures and those of Table 8, in connection **with the volumes of t** prism and of (*e*+*f*) given on pp. 1288 and 1300 of the **report of 1890, we now find** flow at the mouth as deduced from the gauging of 1889, **while the same quantit** deduced from the gauging of 1890 and 1893 has been **rendered above in Table 7.**

TABLE 9.—*The flow at the mouth of Savannah River, as determined from the gaugin 1889.*

1. EBB.

	Cubic fe
Ebb outflow at line F	1,100,200,
Ebb outflow South Channel below St. Augustine Creek	472,900,
Ebb outflow at line G	73,700,

	Cubic feet.
lal prism from line F to line H, North Channel	542,600,000
lal prism from line H to mouth North Channel	80,000,000
lal prism to mouth South Channel	550,000,000
	2,819,400,000
is (e+f) (pp. 1288 and 1300)	140,000,000
Consequently, ebb outflow at mouth (North and South channels)	2,679,400,000

2. FLOOD.

	Cubic feet.
od inflow at line F	675,000,000
od inflow South Channel below St. Augustine Creek	178,900,000
od inflow at line G	87,900,000
n of tidal prisms, as above	1,172,600,000
	2,114,400,000
is (e+f)	140,000,000
Consequently flood inflow at mouth (North and South channels)	1,974,400,000

.n approximate check of the work of 1893 is finally afforded by comparing the volume found at line bell buoy with the sum of the ebb volumes at line I (1890), nouth of South Channel (1893), and at mouth of Lazaretto Creek (1893). If there s no flow across Oyster Bed training wall, then this sum, added to the inclosed al prism, would necessarily be equal to the ebb volume at line bell buoy. But the current, as a matter of fact, does cross the training wall in a southeasterly direc- n (see diagram), and consequently we must expect to find the latter volume some- at greater than the former. The actual figures in the case are as follows:

Ebb flow at line L (bell buoy), as deduced from upper lines.

	Cubic feet.
b volume at line I (gauged 1890)	1,473,600,000
b volume at mouth of South Channel (1893)	781,300,000
b volume at mouth of Lazaretto Creek (1893)	122,700,000
al prism to Oyster Bed training wall and line bell buoy	552,200,000
Consequently, ebb flow at line L (bell buoy)	2,899,800,000
b volume found by gauging on line L (bell buoy) 1893	2,974,600,000

Summary of checks applied to the gauging of 1893.

1. TIDAL.

Date of work.	Tidal volumes.			
	Mouth of North and South Channel.		At line L	
	Ebb.	Flood.	Ebb.	Flood.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
	2,679,400,000	1,974,400,000		
and 1893	2,566,100,000	1,914,460,000	2,899,800,000	
			2,974,600,000	

2. FRESH-WATER FLOW.

	Cubic feet in 12^h 25^m.
found in 1889	705,000,000
found in 1890 and 1893	651,700,000

t should be mentioned here that the corrections applied for fresh-water flow are ject to some doubt. This amount has been deduced from the gauge readings at gusta on the basis of the relations between height of water on gauge and vol- es of discharge, as established by Mr. G. W. Brown. But it is known that the river at Augusta has been considerably raised during the last ten or twelve years, ich movement must have modified the above-mentioned relation. The exact time at which this silting up of the river bed took place is not known. Mr. G. W Brown believes that it happened during the great September freshet of 1888. In the monthly and annual means of gauge readings at Augusta, appended hereto, see to indicate that it was a gradual occurrence, extending over a period of seve years, probably from 1884 to 1891, and possibly interrupted during this time by retr grade movements. If this is true, then all corrections for fresh-water flow appli in this and former reports are subject to errors, the precise extent of which can no be ascertained without the reganging of the river at Augusta, and hence probabl the small discrepancies appearing here and there. Although these discrepancies a not of sufficient importance to impair the practical value of the results obtained, still it might be advisable under the circumstances to once more gauge the river a Augusta under a number of different conditions of height. For every futu gauging at the mouth of the river I would further suggest simultaneous observa tions to be made on the Purysburg gauge, by which means the time of arrival of t freshet and the commencement of its influence on the discharge at the mouth can b determined with great accuracy.

In the preceding discussion the volumes only have been dealt with, while th distribution of flow over the cross sections has not been touched upon. For th outer mouth this is represented in two diagrams (on sheet No. 4) showing the di tribution of mean and of maximum velocities at line L. It may be added that a line M these conditions are quite similar, the greatest velocities there also huggi the Tybee shore. Further details in regard to this are apparent from the append tables, A, giving volumes of discharge.

5. SUMMARY OF RESULTS FOR THE REGION OF THE MOUTH.

Considering all available evidence, the following figures may be looked upo reasonably near the truth:

TABLE 10.—*Tidal volumes at and near the mouth corresponding to mean conditions of t and fresh-water flow.*

Locality.	Ebb.	Flood.
	Cubic feet.	*Cubic fe*
1. Mouth of North Channel (800 feet below Wing Dam 35)	1,785,000,000	1,420,00
2. Mouth of South Channel (at Lazaretto Creek)	781,000,000	494,00
3. Mouth of Lazaretto Creek	123,000,000	83,00
4. Between Oyster Bed Shoal and Cockspur Island (line I)	1,474,000,000	978,00
5. Mouth of Wrights River (line K)	305,000,000	395,00
6. North of Oyster Bed Shoal, including Wrights River	948,000,000	1,081,90
7. Entire flow at mouth proper (sum of 1 and 2)	2,566,000,000	1,914,00
8. At outer mouth, line L (bell buoy)	2,975,000,000	2,100,00

These mean volumes are, of course, susceptible of great changes when either tidal conditions or the conditions of fresh-water flow, or both, depart from mean. In regard to the influence of the variations of fresh-water flow. the follo ing may be said:

The average fresh-water flow is found from the evidence submitted in tables and 10, as follows:

TABLE 11.—*Average fresh-water flow of Savannah River.*

Locality.	During one-half lunar day.	In one sec
	Cubic feet.	*Cubic fe*
At Augusta	510,000,000	1
At Savannah	708,000,000	1
At mouth *	652,000,000	1

* The loss of volume below Savannah is caused by the outflow through St. Augustine Creek

These mean volumes correspond to a guage reading of about 10.5 at Augu When the water rises to 19 feet on the Augusta gauge then the fresh-water flow is just about trebled, and when it rises to 25 feet then the fresh-water flow is a five times as great as normally. In the following three tables the influence of freshets on the discharge is set forth. In computing them it has been assumed three-sevenths of the entire volume passes through cross Section I, and three-fou through cross Section L.

12.—*Tidal flow at mouth of North and South Channel under mean tidal conditions.*

1. FOR AN AVERAGE FRESH-WATER FLOW.

Designation.	Duration.	Average cross section area of discharge.	Volume of discharge—		Mean velocity per second.
			During 12^h 25^m.	During 1 second.	
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
....	6 30	70,000	2,566,000,000	109,700	1.57
....	5 55	84,000	1,914,000,000	90,000	1.07

2. WHEN THE AUGUSTA GAUGE READS 19 FEET.

....	6 30	70,000	3,370,000,000	144,000	2.06
....	5 55	84,000	1,270,000,000	59,700	0.71

3. WHEN THE AUGUSTA GAUGE READS 25 FEET.

....	6 50	70,000	4,195,000,000	170,500	2.44
....	5 35	84,000	695,000,000	34,600	0.41

BLE 13.—*Tidal flow at Oyster Bed Shoal, line I, under mean tidal conditions.*

1. FOR AN AVERAGE FRESH-WATER FLOW.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge—		Mean velocity per second.
			During 12^h 25^m.	During 1 second.	
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
....	6 35	35,200	1,474,000,000	62,200	1.77
....	5 50	40,900	976,000,000	46,500	1.14

2. WHEN THE AUGUSTA GAUGE READS 19 FEET.

....	6 35	35,200	1,815,000,000	76,600	2.18
....	5 50	40,900	695,000,000	33,100	0.81

3. WHEN THE AUGUSTA GAUGE READS 25 FEET.

....	7 00	35,200	2,150,000	90,700	2.58
....	5 25	40,900	430,000	20,500	0.50

14.—*Tidal flow at outer mouth, line L (bell buoy), under mean tidal conditions.*

1. FOR AN AVERAGE FRESH-WATER FLOW.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge—		Mean velocity per second.
			During 12^h 25^m.	During 1 second.	
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
....	6 13	82,000	2,975,000,000	132,900	1.62
....	6 12	92,000	2,100,000,000	94,200	1.02

2. WHEN THE AUGUSTA GAUGE READS 19 FEET.

....	6 13	82,000	3,485,000,000	155,600	1.90
....	6 12	92,000	1,575,000,000	70,600	0.77

3. WHEN THE AUGUSTA GAUGE READS 25 FEET.

....	6 13	82,000	4,010,000,000	179,000	2.18
....	6 12	92,000	1,050,000,000	47,100	0.51

In connection with tables 12, 13, and 14, and in farther illustration of the
ence exercised by the fresh-water flow on the flow in the tidal portion of Sav
River, the following results, gathered from a study of fourteen years' (18
observations at the Augusta gauge, are rendered here.

Freshets of 18 feet least height occur on the average six times annually, with
aggregate duration of twenty-six days. During January, February, and
there is on the average one of those freshets in each month, with an average
tion of five days each. During the remainder of the year there is on the
one such freshet every three months, with an average duration of three and
half days each.

Every year averages nearly three freshets running up to or above 25 feet,
which occur during the first three months of the year. One of these freshets will
up to or above 30 feet, generally during the first three months of the year,
May, August, or September.

The influence exercised on the flow by the varying tidal conditions is
by the following three tables.

TABLE 15.—*Tidal flow at mouth of North and South Channel under mean*
of fresh-water flow.

1. FOR A MEAN TIDE, RISE AND FALL 6.75 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
Ebb	6 30	70,000	2,566,000,000	109,000	1.
Flood	5 55	84,000	1,914,000,000	90,600	1.

2. FOR A MEAN SPRING TIDE, RISE AND FALL 8 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
Ebb	6 30	71,000	2,944,000,000	125,800	1.
Flood	5 55	85,000	2,244,000,000	105,400	1.

3. FOR A HIGH SPRING TIDE, RISE AND FALL 9 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
Ebb	6 30	72,000	3,268,000,000	139,700	1.
Flood	5 55	86,000	2,568,000,000	120,600	1.

TABLE 16.—*Tidal flow at Oyster Bed Shoal, line I, under mean conditions of*
water flow.

1. FOR A MEAN TIDE, RISE AND FALL 6.75 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
Ebb	6 35	35,200	1,474,000,000	62,200	1
Flood	5 50	40,900	976,000,000	46,500	1

2. FOR A MEAN SPRING TIDE, RISE AND FALL 8 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
Ebb	6 35	36,000	1,675,000,000	70,700	[illegible]
Flood	5 50	41,500	1,155,000,000	55,000	[illegible]

3. FOR A HIGH SPRING TIDE, RISE AND FALL 9 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge— During $12^h 25^m$.	Volume of discharge— During 1 second.	Mean velocity p second.
Ebb	6 35	36,500	1,855,000,000	78,300	[illegible]
Flood	5 50	42,000	1,335,000,000	63,600	1

BLE 17.—*Tidal flow at outer mouth, line L (bell buoy), under mean conditions of fresh-water flow.*

1. FOR A MEAN TIDE, RISE AND FALL 6.75 FEET.

Designation.	Duration.	Average cross-section area of discharge.	Volume of discharge—		Mean velocity per second.
			During 12ʰ 25ᵐ.	During 1 second.	
	h. m.	*Square feet.*	*Cubic feet.*	*Cubic feet.*	*Feet.*
b	6 13	82, 000	2, 975, 000, 000	132, 900	1. 62
od	6 12	92, 000	2, 100, 000, 000	94, 200	1. 02

2. FOR A MEAN SPRING TIDE, RISE AND FALL 8 FEET.

Designation.	Duration.	Average cross-section area of discharge.	During 12ʰ 25ᵐ.	During 1 second.	Mean velocity per second.
b	6 13	83, 500	3, 321, 000, 000	148, 300	1. 78
od	6 12	93, 500	2, 461, 000, 000	110, 400	1. 18

3. FOR A HIGH SPRING TIDE, RISE AND FALL 9 FEET.

Designation.	Duration.	Average cross-section area of discharge.	During 12ʰ 25ᵐ.	During 1 second.	Mean velocity per second.
	6 13	85. 000	3, 683, 000, 000	164, 400	1. 93
od	6 12	95, 000	2. 823, 000, 000	126, 600	1. 33

n connection with tables 15, 16, and 17 it should be stated that from a study of year's tidal observations at Fort Pulaski it appears that annually about 136 tidal es, of 8 feet height or more enter, the Savannah River, 40 of which obtain a ght of 9 feet or more. Roughly speaking, it may therefore be said that tides of 8 range or more occur nearly three times a week, and that of these there is nearly every week rising to a height of 9 feet or more.

he above discussion of the tidal flow under other than mean conditions is limited uch conditions that are of comparatively frequent occurrence. Beyond these, umstances will sometimes arise under which the flow may assume very much er proportions. Under the influence of such extreme freshets as occur on the rage once in a year the flood current of the river may be obliterated entirely n to the very mouth, and the ebb discharge during half a lunar day may run up 5,000,000,000 cubic feet or more. But the discharge per second is not increased he same proportion, as the duration of ebb currents is now so much longer, and the n velocity is increased in a still smaller ratio, as the discharge takes place ugh a greater area of cross section. Still it is probable that very high freshets produce in the region of the mouth mean velocities as great as 3½ feet. As we nd from the mouth these velocities increase, and there are therefore created uch a freshet the most unfavorable conditions toward the maintenance of the nnel in the tidal portion of the river. The water will arrive there charged h material scoured out above and ready to deposit the same as soon as the g tide sufficiently slackens the ebb current. The importance of the fresh-water in maintaining a channel in the lower river is dependent not only on its vol- , but also on its uniformity, and the more it loses the latter character the e its beneficial influence will be impaired.

he immediate practical conclusions that can be based upon the current observa- s recently made at the mouth are as follows: The great velocities on the Tybee t side of the outer channel show us that the direction of the North Channel harge can not be parallel to the Oyster Bed training wall, but must incline ard Tybee Point. This is corroborated by the observations of directions rep- nted on sheet No. 4, and also by a series of observations of directions made in ruary, 1894, in the vicinity of Buoy No. 9. You have already decided to arrest this que flow across the Cockspur Island shoals by the construction of a southern ning wall parallel to the Oyster Bed training wall and at a distance of 2,400 from it. There can be no doubt that in this way a greater volume will be cted over the knoll, and the channel as far out as Buoy No. 9 will probably ome permanent, possibly shifting its location to alongside of the new training l.

he main importance of the recent gauging is to be sought in this, that it forms final part of extensive and self-checking work done before those improvements e carried out, which must bring about the most important changes in the regi- n of the river. We therefore now have a very full and reliable record of the ditions of flow as they were before the construction of the Mackay Point, the

South Channel, the North Long Island, and the Cockspur Island works. By of regauging after the completion of these works it will become feasible to nize the changes caused by them and to reliably shape further work towar improvement of the outer mouth.

Submitting the above, I am, Captain,

Very respectfully, your obedient servant,

E. A. GIESELER,
Assistant Engin

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

TABLE A.—*Volumes of discharge corrected to mean tidal conditions.*

LINE L, BELL BUOY, EBB.

	Time of change of current on date after—		Mean duration of flow.	Mean cross-sectional area of discharge on date.	Observed mean length of flow on date.	Ratio of mean rise and fall to rise and fall on date.	Volum discha under m tidal co tions
	H. W.	L. W.					
	Min.	*Min.*	*h. m.*	*Square feet.*	*Feet.*		*Cubic f*
1	54	60		15,600	29,000	1.143	517.1
2		60		20,600	31,750	1.143	747.5
4		45		18,900	31,400	1.143	678.3
5		45		22,800	36,500	1.143	951,3
Shore				3,900	18,000	1.143	80,2
	54	52	6 11	81,800	29,330		2,974,1

LINE M, BUOY NO. 2, EBB.

[NOTE.—The duration of mean ebb flow, as well as the volumes found at line M, are not cons reliable.]

1	60	40		38,000	32,400	1.241	1,527,
2	56	38		14,240	34,326	1.241	606,
3	83	42		13,640	26,010	1.241	440,
4	62	23		28,400	42,984	1.241	1,514,
Shore				7,000	21,500	1.241	186,
	65	36	5 43	100,880	31,440		4,276,

LINE N, MOUTH OF SOUTH CHANNEL, EBB.

Shore				270	22,300	1.0	6,
1	23			1,970	44,600	1.0	87,
2	35			3,530	48,100	1.0	169,
3	36			3,850	45,540	1.0	175,
4	42			6,160	39,600	1.0	243,
	35	57	7 02	15,780	40,028		682,
Tidal prism between Line N and mouth							22,
Ebb discharge at mouth of South Channel							706,

LINE N, FLOOD.

Shore				300	13,200	1.0	4,
1				2,155	26,400	1.0	56,
2				3,820	32,850	1.0	125,
3				4,160	34,600	1.0	143,
4				5,295	33,150	1.0	175,
Shore				1,445	16,500	1.0	23,
	35	57	5 23	17,175	26,120		529,
Tidal prism between Line N and mouth							22,
Flood inflow at mouth of South Channel							552,

SHEET 1

TIDE IN SAVANN

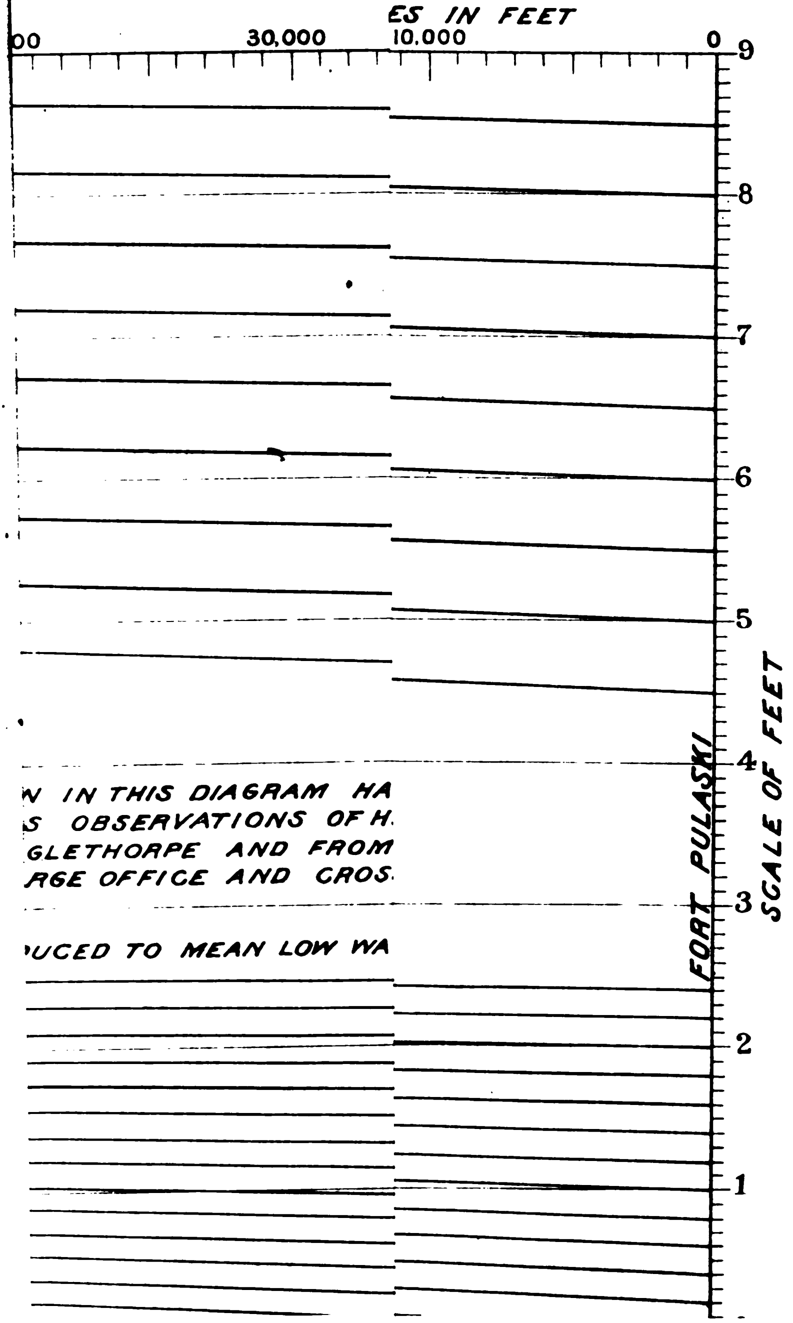

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TABLE A.—*Volumes of discharge corrected to mean tidal conditions*—Continued.

LINE O, LAZARETTO CREEK, EBB.

	Time of change of current on date after— H. W.	L. W.	Mean duration of flow.	Mean cross-sectional area of discharge on date.	Observed mean length of flow on date.	Ratio of mean rise and fall to rise and fall on date.	Volume of discharge under mean tidal conditions.
	Min.	*Min.*	*h. m.*	*Square feet.*	*Feet.*		*Cubic feet.*
ore				560	14,000	1.0	7,800,000
	5	0	6 34	1,740	28,000	1.0	48,700,000
	4	0	6 35	1,540	27,500	1.0	42,400,000
ore				570	13,500	1.0	7,700,000
	5	0	6 35	4,410	20,750		106,600,000
dal prism between Line O and mouth of creek							5,400,000
Ebb discharge at mouth of Lazaretto Creek							112,000,000

LINE O, FLOOD.

ore				600	10,000	1.0	6,000,000
				1,810	19,330	1.0	35,000,000
				1,610	24,050	1.0	38,700,000
ore				610	12,000	1.0	7,300,000
	5	0	5 50	4,630	16,370		87,000,000
dal prism between Line O and mouth of creek							5,400,000
Flood inflow at mouth of Lazaretto Creek							92,400,000

TABLE B.—*Monthly and annual means of readings of river gauge at Augusta, Ga.*

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
n	8.0	12.5	10.9	15.1	9.3	13.7	14.5	7.6	12.1	15.9	7.1	11.4	16.1	13.0
b	8.8	13.0	15.2	9.4	10.5	12.0	9.4	10.7	13.0	16.1	9.0	18.3	11.5	12.8
r	14.5	12.9	12.2	9.0	17.4	8.8	10.1	9.3	13.7	12.2	10.5	19.1	12.1	10.6
r	10.7	9.9	8.8	13.0	12.5	7.5	13.3	7.2	11.5	10.0	8.5	12.7	12.7	7.7
y	8.6	6.9	6.9	8.1	7.9	7.9	12.3	6.7	11.0	7.8	9.2	9.1	8.0	7.6
ne	6.1	6.2	6.5	7.5	11.2	7.7	12.2	7.5	8.7	8.3	7.3	9.0	11.7	8.8
ly	5.2	5.0	6.0	5.1	8.6	6.1	12.8	8.1	7.1	9.8	8.2	7.8	12.0	6.8
g	6.2	4.7	7.6	5.0	6.6	6.0	8.2	16.3	7.4	11.8	7.5	10.6	8.0	7.9
pt	5.7	6.0	9.9	4.5	5.1	7.7	7.0	6.8	18.5	9.2	8.5	7.3	9.4	11.8
t	4.5	4.6	6.0	4.8	4.6	10.0	5.6	7.3	10.4	7.0	12.6	5.9	6.5	7.8
v	6.3	7.7	6.7	5.7	5.2	10.1	6.9	6.5	13.1	9.4	7.3	7.3	7.6	6.4
c	10.0	9.1	8.7	6.1	9.1	10.0	7.9	8.7	10.7	7.3	8.1	8.5	7.8	7.4
An. mean	7.9	8.2	8.8	7.8	9.0	9.0	10.0	8.6	11.4	10.4	8.7	10.6	10.3	9.1

TABLE C.—*Monthly and annual totals of rainfall at Augusta, Ga.*

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1801.	1892.	1893.
n	4.27	8.69	3.38	6.99	4.76	7.39	3.69	4.60	4.25	7.37	0.80	3.28	7.75	2.92
b	3.37	3.98	4.04	1.47	3.98	2.97	1.70	2.95	4.54	5.78	1.58	3.72	2.99	5.26
r	6.43	6.66	6.80	3.11	6.93	1.84	7.41	0.64	7.79	2.72	3.37	8.61	4.56	2.81
r	5.72	4.71	5.11	6.28	3.68	1.39	1.78	2.77	0.87	2.71	2.33	0.86	1.34	0.97
y	2.98	1.35	3.39	2.47	3.21	5.76	5.74	1.15	4.50	1.01	5.28	4.59	2.95	3.22
ne	1.54	2.11	4.18	5.85	4.18	2.80	9.72	5.25	1.85	3.71	2.06	4.46	4.83	7.71
ly	5.98	3.46	3.61	1.88	3.18	3.57	7.87	8.22	1.74	10.41	10.80	6.44	4.14	3.51
g	5.10	4.82	4.97	2.49	4.35	3.32	2.29	7.44	3.75	8.09	2.26	8.12	2.46	8.04
t	0.83	7.01	3.22	1.22	4.23	2.78	0.65	0.81	7.82	3.00	8.91	2.15	5.49	4.43
t	2.03	2.33	2.72	1.72	0.83	4.07	0.14	6.58	6.37	1.61	3.96	0.59	0.27	4.56
v	4.67	3.79	3.92	3.64	1.71	1.32	1.29	0.77	2.34	2.73	0.47	2.58	1.32	1.98
c	4.13	4.96	4.44	2.17	4.19	2.14	2.82	4.64	3.60	0.55	1.18	2.78	1.22	3.50
An. total	47.05	53.87	49.78	39.29	45.23	39.35	45.10	45.82	49.42	49.69	43.00	48.16	39.32	48.91

TABLE D.—*Daily and monthly mean discharge, in thousands of cubic feet per second, of Savannah River at Augusta in 1889.*

[Mean discharge for year, 12,750 cubic feet.]

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	13.6	18.0	17.3	10.2	7.5	18.0	15.5	13.1	10.2	6.2	5.1
2	18.0	16.3	16.3	11.4	7.5	12.1	23.3	23.6	7.0	6.2	5.1
3	15.0	14.8	17.8	12.6	9.0	7.7	18.8	25.3	7.0	6.3	4.9
4	11.6	13.8	42.9	11.0	8.2	6.5	14.0	39.0	6.6	6.0	5.5
5	30.8	13.1	35.6	10.2	7.5	6.6	16.0	25.0	6.3	5.8	6.8
6	51.2	12.6	25.0	9.8	7.1	8.0	22.2	26.2	6.2	5.5	6.2
7	41.8	12.1	19.0	9.2	7.0	7.1	15.5	26.2	8.8	5.2	5.5
8	25.6	11.2	16.8	8.8	6.8	6.3	8.2	18.0	17.8	5.2	5.2
9	17.8	10.8	15.0	8.8	6.8	5.6	6.5	11.6	14.8	5.1	5.1
10	19.5	11.0	13.8	8.8	6.6	5.5	5.9	8.0	10.4	4.9	4.9
11	23.3	10.8	12.8	8.6	6.6	8.4	5.5	6.6	7.5	4.9	6.3
12	18.5	10.6	12.6	8.6	6.3	6.8	5.3	7.7	6.8	4.9	6.2
13	14.5	10.6	12.1	8.4	5.9	9.0	5.9	19.5	6.2	4.9	6.0
14	12.6	10.2	12.1	8.2	6.3	10.2	5.5	26.8	5.5	4.8	5.6
15	11.0	10.6	12.1	10.6	6.3	8.0	6.5	31.5	5.2	4.8	8.2
16	11.2	39.8	12.1	20.0	6.3	6.2	6.0	28.7	5.2	4.8	7.9
17	15.3	48.0	11.4	24.4	6.3	6.6	5.5	19.5	5.1	4.6	7.1
18	35.2	94.7	11.0	17.0	6.0	6.6	7.0	10.4	4.9	4.6	20.5
19	36.3	121.0	12.1	13.4	5.8	5.8	5.8	7.0	4.9	4.4	27.2
20	25.6	83.8	14.8	10.4	5.6	5.5	6.2	6.3	7.9	4.4	18.0
21	33.5	50.0	15.0	9.6	5.9	5.5	5.5	6.0	6.5	4.4	11.6
22	36.7	34.8	13.4	9.0	5.9	5.6	5.2	5.6	5.5	4.4	20.0
23	26.2	49.2	11.0	8.8	5.9	6.2	4.9	5.5	5.1	4.4	24.2
24	19.5	47.6	10.4	8.4	5.5	5.5	4.9	5.2	6.3	4.5	16.5
25	22.7	38.2	12.1	8.4	5.5	5.1	4.6	6.3	24.7	4.5	10.4
26	27.8	28.1	20.3	9.0	5.2	4.9	5.8	22.2	35.2	4.9	8.4
27	47.6	21.4	18.3	10.6	5.2	4.8	14.8	11.4	23.0	6.3	7.5
28	60.1	19.0	14.3	9.0	5.2	4.8	25.0	8.2	11.4	7.9	7.1
29	46.8	....	12.1	8.0	5.1	5.1	26.5	6.5	7.3	6.3	7.9
30	31.5	....	10.8	7.7	4.9	21.4	16.8	9.8	6.5	5.6	8.4
31	21.9	....	10.2	....	8.0	....	18.3	14.0	....	5.1	....
Mean	26.5	30.8	15.8	10.6	6.4	7.5	10.9	15.5	9.5	5.2	9.9

TABLE D.—*Daily and monthly mean discharge, in thousands of cubic feet per second, of Savannah River at Augusta in 1890.*

[Mean discharge for year, 8,770 cubic feet.]

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	5.3	10.6	44.4	7.3	5.8	6.8	3.6	8.8	7.1	78.2	7.0
2	5.6	7.7	33.8	7.3	5.5	6.3	5.1	7.0	5.2	52.2	6.3
3	5.8	6.5	23.3	8.2	5.5	8.0	5.1	5.9	4.6	32.8	6.3
4	6.2	6.2	15.8	8.2	5.3	9.2	4.9	5.8	4.6	26.5	6.3
5	5.6	5.8	11.2	9.6	8.0	7.0	4.5	5.5	4.9	17.5	6.2
6	5.8	5.6	9.8	15.5	13.3	6.0	4.2	9.4	5.9	10.8	6.2
7	5.5	5.6	8.6	10.2	10.0	6.2	4.1	8.4	5.8	8.0	6.2
8	5.5	5.5	8.6	8.2	8.4	5.6	4.5	8.2	5.2	7.0	5.9
9	5.3	7.3	7.8	7.7	6.5	5.5	7.5	8.0	5.8	7.3	5.6
10	5.3	11.0	7.6	7.3	6.2	5.2	5.2	6.5	6.8	7.5	5.5
11	5.2	9.4	7.3	7.1	5.5	5.1	4.5	6.2	8.8	6.8	5.5
12	5.1	7.9	7.0	7.0	5.3	6.5	3.9	7.0	5.9	6.2	5.5
13	5.2	10.2	6.8	6.3	5.2	5.8	3.4	6.6	5.3	5.9	5.5
14	5 1	8.8	7.0	6.3	5.2	5.1	3.3	5.2	9.0	5.8	5.8
15	5.1	8.4	7.0	6.3	5.5	4.9	3.1	4.6	9.6	5.6	5.8
16	5.1	10.2	8.8	6.3	9.2	5.1	2.9	4.5	7.5	5.3	5.3
17	5.1	9.2	8.2	7.1	8.6	4.9	3.2	3.9	6.8	10.4	5.5
18	5.1	7.7	7.1	9.8	6.3	4.9	3.4	4.2	5.6	23.3	5.8
19	5.5	7.0	6.6	10.6	5.9	6.0	5.3	4.1	5.2	15.8	5.6
20	5.2	6.6	6.6	9.2	5.9	5.1	7.0	4.2	5.1	9.0	5.6
21	5.1	6.3	6.8	7.9	16.0	5.2	6.8	4.2	4.5	6.6	5.5
22	5.1	6.3	8.6	7.0	11.0	5.1	4.6	3.9	5.2	6.2	5.2
23	5.1	5.8	12.1	6.5	9.0	5.9	4.5	4.1	6.2	31.8	5.1
24	5.1	5.8	26.8	6.3	5.8	5.8	3.8	3.8	6.6	73.4	5.1
25	5.1	5.8	20.8	6.2	5.2	4.6	3.9	3.8	8.0	57.4	4.9
26	4.9	5.8	14.0	6.0	5.2	6.0	32.8	3.8	10.0	33.2	4.9
27	5.1	14.5	10.8	6.0	19.3	5.1	27.8	3.6	7.1	18.5	5.1
28	5.1	46.4	10.4	5.9	40.1	4.8	21.9	3.6	9.2	10.8	5.1
29	4.9	....	9.8	5.9	28.1	4.4	27.8	4.9	12.6	8.6	5.1
30	5.2	....	9.0	5.8	14.8	4.1	23.3	17.0	56.4	7.9	5.1
31	9.2	....	7.9	....	9.2	....	14.5	15.3	....	7.3	....
Mean	5.4	9.1	12.3	7.6	9.7	5.7	8.4	6.2	13.1	15.2	5.6

BLE D.—*Daily and monthly mean discharge, in thousands of cubic feet per second, of Savannah River at Augusta in 1891.*

[Mean discharge for year, 14,160 feet.]

ate.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
....	5.9	26.2	22.4	33.8	8.8	8.6	5.5	18.8	9.6	4.9	3.4	6.3
....	5.8	37.1	16.8	41.3	8.8	7.7	5.2	14.5	6.8	4.5	3.3	5.8
....	5.6	45.2	15.8	53.0	8.6	7.0	4.9	17.5	6.2	4.2	3.4	5.5
....	11.4	56.0	14.5	41.3	8.6	6.8	4.6	12.8	6.6	3.7	3.4	5.8
....	8.4	53.0	14.5	27.8	8.2	6.5	4.5	9.4	10.4	4.2	3.8	8.8
....	7.0	33.5	15.0	21.4	8.0	6.8	4.5	7.5	16.3	3.9	3.7	13.1
....	6.3	21.6	19.3	19.0	7.9	7.1	4.5	6.5	8.8	3.9	3.7	8.8
....	6.2	63.4	34.8	17.0	7.7	11.4	4.5	6.0	6.5	3.7	3.3	7.3
....	6.0	70.6	100.2	16.0	7.5	15.8	4.8	5.6	5.8	3.8	3.7	10.8
....	6.0	50.4	163.0	15.3	7.1	15.0	7.7	5.3	5.5	4.2	3.7	9.4
....	13.4	43.7	117.2	14.8	7.3	14.8	6.3	5.2	5.2	3.9	4.2	7.5
....	36.7	41.0	73.5	15.3	7.1	14.5	5.1	5.5	5.3	3.9	5.2	6.8
....	44.5	26.5	100.3	14.5	7.1	16.0	4.8	5.2	4.9	4.2	8.0	6.0
....	28.7	21.6	85.4	13.8	8.0	13.6	4.5	5.3	5.6	3.9	5.5	6.3
....	17.0	20.3	48.8	13.1	13.3	10.8	4.5	5.5	5.5	4.6	4.5	5.9
....	11.0	17.8	32.2	12.6	14.5	8.8	4.5	5.2	5.3	3.9	4.4	6.3
....	13.8	22.2	24.7	13.1	10.4	7.9	4.6	4.9	5.1	3.8	4.2	7.0
....	17.5	29.6	22.2	12.8	8.4	7.0	4.9	4.5	4.9	3.4	4.4	9.0
....	14.0	28.1	22.2	12.1	7.9	7.9	8.0	4.0	4.6	3.7	4.6	7.7
....	10.4	21.4	26.8	11.4	7.7	7.3	9.2	5.2	4.2	3.7	4.9	7.1
....	9.0	18.8	23.0	11.2	8.0	7.3	6.3	5.5	4.2	3.6	4.5	7.5
....	8.4	28.1	20.8	11.0	8.0	5.9	6.6	8.2	4.4	3.6	3.7	7.0
....	11.2	40.6	21.4	10.8	7.5	6.5	5.9	8.8	4.1	3.7	4.9	6.6
....	22.7	28.1	18.8	10.8	6.8	6.6	6.5	8.4	4.2	3.3	20.0	7.5
....	16.0	20.5	16.8	14.5	6.8	6.2	6.6	17.0	4.2	3.3	25.0	8.2
....	12.8	18.3	15.5	13.4	6.8	5.9	6.6	21.4	4.2	3.4	13.3	8.8
....	13.4	42.1	57.9	10.4	7.5	5.5	8.0	53.8	3.6	3.4	8.6	8.4
....	10.4	34.4	82.0	9.8	10.0	5.1	13.6	61.5	3.7	3.3	7.0	7.5
....	9.6	....	57.4	9.4	12.1	5.1	10.4	42.1	4.2	3.3	6.6	7.7
....	28.7	....	36.0	9.2	11.9	4.9	12.6	29.3	5.3	3.4	5.9	7.0
....	38.6	....	24.2	....	10.2	....	16.5	21.4	....	3.4	....	6.6
Mean ..	14.7	34.3	43.3	17.6	8.7	8.7	6.7	14.0	5.8	3.8	6.2	7.6

LE D.—*Daily and monthly mean discharge, in thousands of cubic feet per second, of Savannah River at Augusta in 1892.*

[Mean discharge for year, 12,700 cubic feet.]

ate.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
....	6.5	9.4	10.0	13.1	7.5	5.2	13.8	5.8	6.0	5.5	3.9	5.2
....	6.3	9.0	9.8	11.4	7.3	5.9	8.6	5.8	5.2	5.6	3.8	5.1
....	10.4	8.8	8.4	10.2	7.1	7.0	10.2	5.6	4.8	4.9	3.9	4.4
....	11.9	8.4	8.2	9.4	7.1	7.5	8.0	7.5	4.8	4.9	4.1	4.9
....	8.4	8.0	7.9	9.0	7.1	26.5	9.6	8.2	4.5	4.9	3.9	4.9
....	8.6	7.5	7.9	8.8	7.0	29.6	15.0	7.1	4.2	4.6	4.5	4.9
....	17.0	8.0	9.8	14.5	6.6	21.1	22.4	6.8	3.9	4.8	4.5	4.9
....	16.3	8.4	11.9	57.4	6.5	15.5	20.0	6.3	4.2	4.9	4.4	5.1
....	10.8	22.4	31.2	61.0	6.3	10.4	14.5	5.8	3.9	4.8	5.5	5.1
....	8.2	21.9	31.8	44.9	6.2	24.2	13.8	7.1	3.8	4.8	8.0	5.2
....	10.0	16.0	19.8	25.0	8.0	22.2	46.0	6.3	4.5	4.8	12.8	5.1
....	42.9	11.4	12.6	18.0	9.6	13.1	58.3	6.3	3.8	4.8	11.9	4.9
....	52.5	9.8	14.8	14.8	10.0	9.0	43.7	5.8	4.1	4.8	7.7	4.6
....	54.2	9.0	9.4	13.1	7.5	7.5	26.8	5.6	8.0	4.8	7.5	426
....	54.2	8.4	8.6	12.6	6.6	7.0	20.5	5.8	26.5	4.6	6.0	4.6
....	74.5	12.4	8.4	13.1	6.3	6.5	15.3	5.2	15.5	4.6	8.4	5.2
....	40.2	12.6	8.2	11.2	6.3	5.8	12.1	4.9	8.4	3.8	10.2	5.3
....	28.7	10.0	8.4	10.0	6.0	5.6	20.3	4.9	6.6	4.2	7.3	7.1
....	65.4	8.2	8.2	9.8	6.3	6.2	23.0	5.9	6.0	4.4	7.0	9.6
....	98.2	8.2	8.4	9.6	6.3	7.0	14.5	6.2	17.8	4.2	8.2	8.6
....	116.0	10.0	7.5	11.2	7.1	18.8	11.4	5.2	15.8	4.2	6.8	24.2
....	68.4	62.5	7.3	12.1	6.5	27.5	10.4	4.9	21.4	4.2	6.0	21.1
....	37.9	55.5	7.3	10.4	6.2	22.4	9.6	4.8	42.1	4.2	5.8	12.6
....	23.3	30.9	7.1	10.0	6.0	21.6	8.8	7.5	37.9	4.2	5.5	8.2
....	17.0	17.8	19.8	10.0	6.3	15.5	8.2	12.1	23.3	4.2	5.5	6.6
....	15.0	14.5	35.5	9.0	5.8	13.3	8.0	14.8	9.6	4.6	5.3	6.2
....	13.1	11.9	67.5	8.4	5.5	19.0	7.5	10.8	7.5	4.4	5.5	5.2
....	11.9	10.0	57.4	8.2	5.5	21.4	6.8	8.6	6.5	4.5	4.4	6.2
....	10.6	9.8	38.2	8.0	5.5	28.4	6.5	5.5	6.2	4.2	4.9	5.8
....	10.4	....	22.2	7.7	5.2	21.1	6.3	6.8	5.8	4.2	5.1	5.6
....	9.6	....	14.8	....	5.2	....	6.2	6.6	....	4.2	....	5.5
Mean ..	30.9	15.2	17.0	15.7	6.7	15.0	16.3	6.8	10.7	4.6	6.3	7.0

TABLE D.—*Daily and monthly mean discharge, in thousands of cubic feet per*
Savannah River at Augusta in 1893.

[Mean discharge for year, 8,760 cubic feet.]

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	5.2	12.1	42.9	6.5	5.5	7.0	4.5	8.2	21.4	4.8	3.8
2	5.9	8.8	34.2	6.3	5.2	6.6	4.4	8.0	50.8	4.5	3.7
3	7.5	7.5	22.2	6.3	6.0	9.6	4.1	6.8	50.4	4.5	3.5
4	8.2	7.0	20.2	6.0	10.0	10.0	4.8	4.8	30.8	7.0	4.2
5	6.6	6.6	27.5	6.2	16.0	9.6	4.9	5.2	13.1	8.0	3.9
6	6.0	7.1	19.3	6.5	12.1	10.2	4.5	5.3	9.4	7.0	3.7
7	5.9	6.2	14.0	6.3	7.9	13.3	4.2	11.4	6.2	5.8	4.2
8	5.2	8.0	10.6	6.0	7.0	18.8	3.8	10.0	5.5	4.9	4.8
9	5.2	7.5	9.8	5.3	6.6	13.1	3.9	5.3	4.9	4.8	4.9
10	4.9	6.6	10.8	5.5	6.8	8.6	4.9	4.5	12.6	4.5	5.1
11	5.1	6.6	18.3	5.5	7.0	7.0	4.8	4.4	38.2	4.5	4.9
12	5.1	10.0	12.4	5.5	6.3	5.9	3.5	3.6	34.6	4.4	4.8
13	5.1	36.0	10.6	5.3	5.9	5.6	3.3	3.7	36.0	4.9	4.2
14	5.2	59.6	10.0	5.1	5.5	7.3	3.2	8.0	39.8	34.9	4.4
15	4.9	50.8	8.8	5.6	5.3	16.0	3.1	14.8	33.5	28.7	3.9
16	4.9	47.2	8.0	5.6	5.1	11.9	3.1	15.5	22.7	14.5	4.4
17	4.8	57.8	8.0	5.1	5.1	7.5	3.3	9.2	14.5	7.3	4.2
18	4.5	48.4	7.7	5.1	6.2	6.5	3.2	5.6	11.4	5.9	4.2
19	4.5	38.4	7.7	4.1	5.5	6.0	3.8	4.8	7.7	5.2	4.4
20	4.5	25.3	7.1	4.1	4.9	6.5	4.5	4.9	7.0	4.9	3.8
21	5.1	17.8	6.8	7.0	4.6	7.7	6.0	3.8	6.3	5.2	4.2
22	5.5	13.8	7.0	17.8	4.5	7.9	16.3	3.6	6.0	4.8	4.5
23	5.2	12.1	6.6	10.8	4.5	9.6	18.3	3.4	5.6	4.6	5.2
24	5.9	6.0	6.6	7.7	4.4	9.0	12.6	3.2	5.3	4.9	5.7
25	7.0	10.0	7.1	6.5	4.2	7.3	6.8	3.0	5.1	4.9	4.8
26	7.9	9.8	8.8	6.2	4.5	5.6	4.4	2.9	4.9	4.8	4.6
27	9.0	8.2	8.0	5.9	4,5	4.9	4.2	3.8	5.1	4.5	3.8
28	9.8	15.5	7.1	5.9	4.4	5.1	4.2	8.8	5.2	4.5	4.6
29	10.0	....	7.1	5.8	4.1	4.8	4.2	17.3	5.1	4.5	4.8
30	14.3	....	7.1	5.6	4.8	4.5	3.9	17.0	4.9	4.4	7.0
31	17.5	....	6.6	....	9.6	....	3.8	8.8	....	3.9	....
Mean	6.7	19.6	12.5	6.4	6.3	8.4	5.3	7.1	16.8	7.2	4.5

COMMERCIAL STATISTICS.

Cotton statistics of the port of Savannah, Ga., for the commercial year ending
31, 1893.

RECEIPTS FROM ALL SOURCES.

	Quantity.	Weight.
	Bales.	*Pounds.*
Upland	758,110	369,552,687
Sea island	35,779	14,381,726
Total	793,898	383,934,413

EXPORTS FROM SAVANNAH.

	Upland.
	Bales.
Coastwise	394,856
Great Britain	55,931
France	24,200
Other continental ports	279,280
Mill consumption and burnt	1,916
Reshipped to interior	205
Total	756,388

TOTAL EXPORTS, ETC.

	Quantity.	Weight.
	Bales.	*Pounds.*
Upland	756,388	368,709,194
Sea island	36,162	14,535,677
Total	792,550	383,244,871

n statistics of the port of Savannah, Ga., for the commercial year ending August 31, 1893—**Continued.**

TOTAL EXPORTS, ETC.—Continued.

	Exports.		Average value per bale.	Average weight per bale.
	Foreign.	Coastwise.		
	Bales.	*Bales.*		*Pounds.*
d	361, 532	394, 856	$41. 54	487
land	6, 331	29, 831	86. 82	402

al and clearance of vessels and commerce at Savannah, Ga., from January 1, 1873, to December 31, 1893.

ARRIVED.

	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
..	463	381, 595	11, 934	34	16, 140	383	213	119, 316	2, 999	710	517, 051	15, 316	17. 50
..	418	354, 700	10, 048	66	41, 030	847	284	182, 517	4, 232	768	578, 247	15, 127	17. 50
..	370	310, 877	10, 102	67	39, 832	781	222	145, 748	3, 290	659	495, 923	14, 173	17. 50
..	355	320, 015	10, 348	58	40, 298	987	260	169, 640	3, 865	673	530, 496	15, 200	17. 75
..	333	379, 826	10, 867	54	40, 948	951	287	168, 247	3, 950	674	589, 021	15, 768	18. 25
..	322	385, 532	10, 688	61	45, 208	576	326	235, 787	5, 814	709	666, 527	18, 078	18. 50
..	319	414, 794	8, 235	30	21, 994	1, 576	279	198, 040	3, 960	628	634, 828	12, 634	17. 75
..	338	446, 881	9, 996	14	7, 724	439	244	172, 224	3, 533	596	626, 829	13, 699	18. 33
..	383	508, 422	11, 069	21	10, 729	170	254	151, 463	3, 474	658	670, 614	14, 780	19. 00
..	391	514, 488	12, 605	11	4, 865	237	204	115, 061	2, 718	606	666, 374	16, 429	19. 00
..	380	468, 226	10, 650	10	4, 115	106	160	87, 020	1, 965	550	559, 366	12, 714	18. 25
..	388	482, 917	13, 735	14	5, 632	90	287	174, 676	3, 984	689	663, 225	17, 835	19. 00
..	395	493, 610	14. 622	12	5, 058	116	251	163, 321	3, 416	658	668, 989	18, 163	20. 75
..	393	503, 073	14. 534	10	5, 952	125	268	177, 229	3, 719	671	686, 254	18, 438	20. 00
..	430	543, 235	15. 127	8	2, 725	185	231	130, 136	2, 800	669	676, 096	17, 987	20. 40
..	411	529, 576	14, 907	8	3, 560	60	229	146. 075	3, 288	648	689, 211	18, 306	20. 67
..	409	561. 463	15, 547	12	6, 563	111	309	215, 865	4, 530	730	783, 891	20, 231	20. 70
..	483	717, 561	19, 178	9	2, 303	69	300	193, 263	4, 058	792	913, 217	23, 305	20. 00
..	484	719, 328	19, 014	13	4, 778	123	325	238, 123	4. 790	822	962, 229	23, 927	20. 00
..	449	692, 728	18, 345	6	3, 000	51	358	259, 482	5, 228	813	955, 208	23, 624	20. 00
..	445	667, 848	16, 970	7	2, 761	59	330	255, 632	4, 976	775	923, 480	21, 946	22. 12

CLEARED.

..	466	398, 050	13, 749	65	30, 102	669	224	129. 164	3, 194	755	557, 316	17, 632	17. 50
..	480	407, 295	12, 748	71	40, 397	822	229	145, 038	3, 437	780	592, 730	17, 007	17. 50
..	319	234, 831	9, 376	72	39, 311	804	195	128, 066	2, 924	586	452, 228	13, 104	17. 50
..	410	361, 909	11, 222	80	49, 483	1, 163	185	119, 699	2, 827	675	531, 781	15, 212	17. 75
..	400	439, 370	12, 081	65	44, 829	1, 066	161	103, 342	2, 489	626	587, 541	15, 736	18. 22
..	378	418, 958	10, 475	64	40, 128	1, 255	260	183, 757	5, 375	702	642, 843	17, 105	18. 50
..	365	442, 734	8, 834	36	24, 891	497	223	156, 470	3, 129	624	624, 095	12, 460	17. 75
..	310	434, 864	10. 108	26	12, 536	271	242	168, 255	3, 446	578	615, 655	13, 825	18. 33
..	369	508, 422	11, 458	22	13, 052	253	261	180, 579	3, 745	652	702, 053	15, 456	19. 00
..	350	596, 213	11, 917	23	9, 155	205	209	135, 375	3, 023	582	650, 743	15, 145	19. 00
..	355	415, 720	9, 780	10	4, 115	90	165	87. 400	2, 015	530	507, 235	11, 885	18. 25
..	360	452, 802	13, 363	15	5, 634	131	288	194, 075	4, 315	663	652, 411	17, 809	19. 00
..	414	502, 773	14, 672	20	8, 722	148	228	154, 858	3, 344	662	666, 353	18, 164	20. 17
..	378	473, 134	13, 912	3	939	24	262	194. 793	3, 970	643	668, 867	17, 906	20. 00
..	380	480, 030	14. 167	4	678	29	269	202, 656	4, 186	653	683, 364	18, 382	20. 00
..	382	507, 075	14, 231	8	2, 583	63	233	167, 836	3, 557	623	677, 494	17, 851	......
..	395	540, 293	15. 505	7	1, 323	51	307	226, 181	4, 601	711	767, 747	20, 157	......
..	452	613, 227	18. 815	14	4, 087	161	323	248, 013	5, 078	789	915, 327	24, 054	20. 75
..	445	666, 900	18, 200	4	9. 909	208	939	271, 067	5, 429	788	957, 876	23, 837	20. 75
..	453	685, 620	18, 285	7	1, 766	48	353	263, 166	5, 151	813	950, 552	23, 484	21. 60
..	411	622, 381	16, 190	9	4, 059	75	338	282, 680	5, 524	749	905, 061	21, 714	21. 75

J. F. B. Beckwith,
Collector.

pt. O. M. Carter,
Corps of Engineers, U. S. A.

Arrival and clearance of vessels and commerce at Savannah, Ga., etc.—**Continued**

COMMERCE.

Years.	Value of exports.	Value of imports.	Duties collected.	Years.	Value of exports.	Value of imports.	Duties collected.
1877	$32,103,853	$36,307,908	$34,959.93	1886	$51,033,190	$51,118,524	$35,455.5
1878	40,028,988	42,948,465	23,364.35	1887	54,774,082	52,659,223	48,837.12
1879	40,901,421	43,064,472	27,778.73	1888	56,435,601	53,412,920	98,213.75
1880	47,836,411	45,522,480	78,458.41	1889	62,892,429	55,062,710	58,815.54
1881	58,985,901	48,716,900	356,550.22	1890	84,584,326	68,229,825	57,542.57
1882	52,004,248	45,952,105	61,148.70	1891	83,367,157	67,248,000	56,714.5
1883	53,915,934	47,699,796	65,245.34	1892	67,211,175	54,119,194	47,687.0
1884	46,425,513	49,112,316	49,147.28	1893*	23,535,503	450,378	56,664.9
1885	48,313,210	49,881,080	45,161.40				

*Foreign only.

N 2.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA.

The Savannah River is formed by the junction of the Tugaloo and Keowee, and flows in a southeasterly direction to the sea.

A detailed description of this river is found in my report of the examination and survey of the portion above Augusta, printed as House Ex. Doc. No. 213, Fifty-first Congress, first session, and in my report of the survey of the river between Augusta and Savannah, dated June 30, 1890, and printed as Appendix O 2, Annual Report of the Chief of Engineers for 1890, pp. 1328–1363.

For a special history of past work see p. 1029, Annual Report of the Chief of Engineers for 1888, and the annual reports of the same officer since that date.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 4 to 5 feet of water, but during the low-water season there are various shoals in the upper part of the river with low-water depths of not more than about 3 feet. The chief obstruction to navigation consists of sand and gravel bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The plan of improvement, as outlined in my report of June 30, 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah.

This is to be accomplished by (1) removing sand and gravel bars; (2) regulating portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement is estimated in round numbers at $332,000, provided funds are regularly and adequately supplied.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

The first appropriation ever made for the Savannah River was expended on a snag boat built for use upon this river and the Altamaha. This boat began work upon the river on February 17, 1882, and has been employed at intervals since that date, continuous work having been impossible on account of insufficiency of funds. Irregular and inadequate appropriations have prevented the selection of the most suitable seasons for doing work. Then, too, the boat has been tied up for months at a time in a climate where decay is very rapid. As a result, numerous and costly repairs have had to be made which would not have been needed had the boat been kept in commission. In 1889 the boat had become rotten and unserviceable, and was rebuilt at Abbeville, Ga., under contract with Messrs. M. A. Sweeney & Bro., of Jeffersonville, Ind., and outfitted at Savannah. In all, the boat was employed 881 days upon the river between Augusta and Savannah, removing during that time 1 sunken steamboat, 82 piles, 2,732 snags, logs, and stumps, and 13,341 overhanging trees, besides a number of wrecked flats and a number of other minor obstructions. Many of the obstacles were very large and troublesome, and their removal without a suitable snag boat would have been impossible.

In 1883–1885 wing dams, projecting from the South Carolina bank, were built for the improvement of Gardner Bar, opposite the city of Augusta, contracting the low-water way from 650 to 350 feet. In the same year and in 1891 shore protection was put in at various points along and below the city front. Contracting works have also been constructed at Course Bar, Sand Bar Ferry, and Blue House Bar, situated 2, 4, and 6 miles, respectively, below the city of Augusta.

At Course Bar 7 wing dams have been built, 3 on the right bank and 4 on the left, reducing the low-water way from 650 to 350 feet. At Sand Bar Ferry 5 wing dams were built, 1 on the right bank and 4 on the left, reducing the width of the low-water way from 650 to 400 feet, and in 1889 2 additional wing dams were constructed on the right side of the river and the old work was raised and repaired, reducing the low-water width to 350 feet.

At Blue House Bar 7 wing dams were built, 4 on the right bank and 3 on the left, reducing the width of the low-water way from 650 to 400 feet. In 1889, the channel having shifted, a new dam, 580 feet long, was constructed, springing from the right bank, and 3 additional short spurs were built on the left bank. Portions of the old dams were removed and the resulting low-water channel was 350 feet in width.

These various works have been built of brush fascines loaded with gravel and riprap stone. In their construction and occasional repair there have been used a total of 22,481.01 cubic yards of brush fascines and 12,776.56 cubic yards of gravel and stone. All work, with the exception of that done by the snag boat, has been done by contract.

Up to July 1, 1893, the total expenditures for the work under the existing project, including all outstanding liabilities, were $34,105.35.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

A contract was entered into on July 5, 1893, with Albert J. Twiggs, of Augusta, Ga., for the construction and repair of wing dams and shore protection near the city of Augusta, and work under this contract was begun on August 10. The work not being completed within the stipulated time, nor within the two time extensions successively granted, a supplemental contract was entered into on November 6, under the conditions of which a part of the remaining work was completed by the Government, with hired labor, at the contractor's expense.

There were built 29 new spur dams on the Georgia side and 6 new spur dams on the Carolina side, of an aggregate length of 2,300 feet, in the construction of which there were used 3,865.86 cubic yards of fascines and 3,263.92 cubic yards of stone.

In the repairing and extending of 12 old spur dams on the Carolina side and 9 old spur dams on the Georgia side there were used 2,578.18 cubic yards of fascines and 2,479.79 cubic yards of stone.

The building of new shore protection was completed at eight points on the Georgia side, with an aggregate length of 688.5 feet, in the construction of which there were used 463.5 cubic yards of fascines and 587 cubic yards of stone.

The building of new shore protection was begun, but not completed, at twenty-one points on the Georgia side. An aggregate length of 589.5 feet was constructed, using 324.5 cubic yards of fascines and 406 cubic yards of stone.

In compensation for extra work done by the contractor there were allowed to him 5.75 cubic yards of stone. Altogether there were, therefore, used 7,232.04 cubic yards of fascines and 6,742.46 cubic yards of stone. Of these entire quantities, 5,682.52 cubic yards of fascines and 5,152.71 cubic yards of stone were put into the works by the contractor, while 1,549.52 cubic yards of fascines and 1,589.75 cubic yards of stone were put into the works by the Government, in accordance with the supplementary contract of November 6, 1893.

The snag boat *Toccoa* commenced operations immediately above Savannah on December 26, and reached Augusta on January 20, 1894, having in the meantime removed all snags seriously obstructing the channel between those two points. There were removed 283 snags and stumps, 14 logs were cut up on bank, and 348 overhanging trees were cut and removed from the banks. The snag boat *Satilla* commenced operations June 27 and continued until the end of the fiscal year, removing during this time, from between 14½ and 30½ miles, 23 snags, 11 overhanging trees, and 1 log. This work was done by hired labor and purchase of material in open market.

CONDITION OF WORK JUNE 30, 1894.

The works designed to contract the low-water channel and to protect the river banks in and below the city of Augusta are in good condition.

The river is obstructed at various points by a number of wrecks which greatly interfere with the through freight commerce, causing irregularity in the trips of the steamboats and failure in making connection with the steamers at Savannah. These wrecks should be removed. By hired labor and purchase of material in open market, this could be done for $10,000.

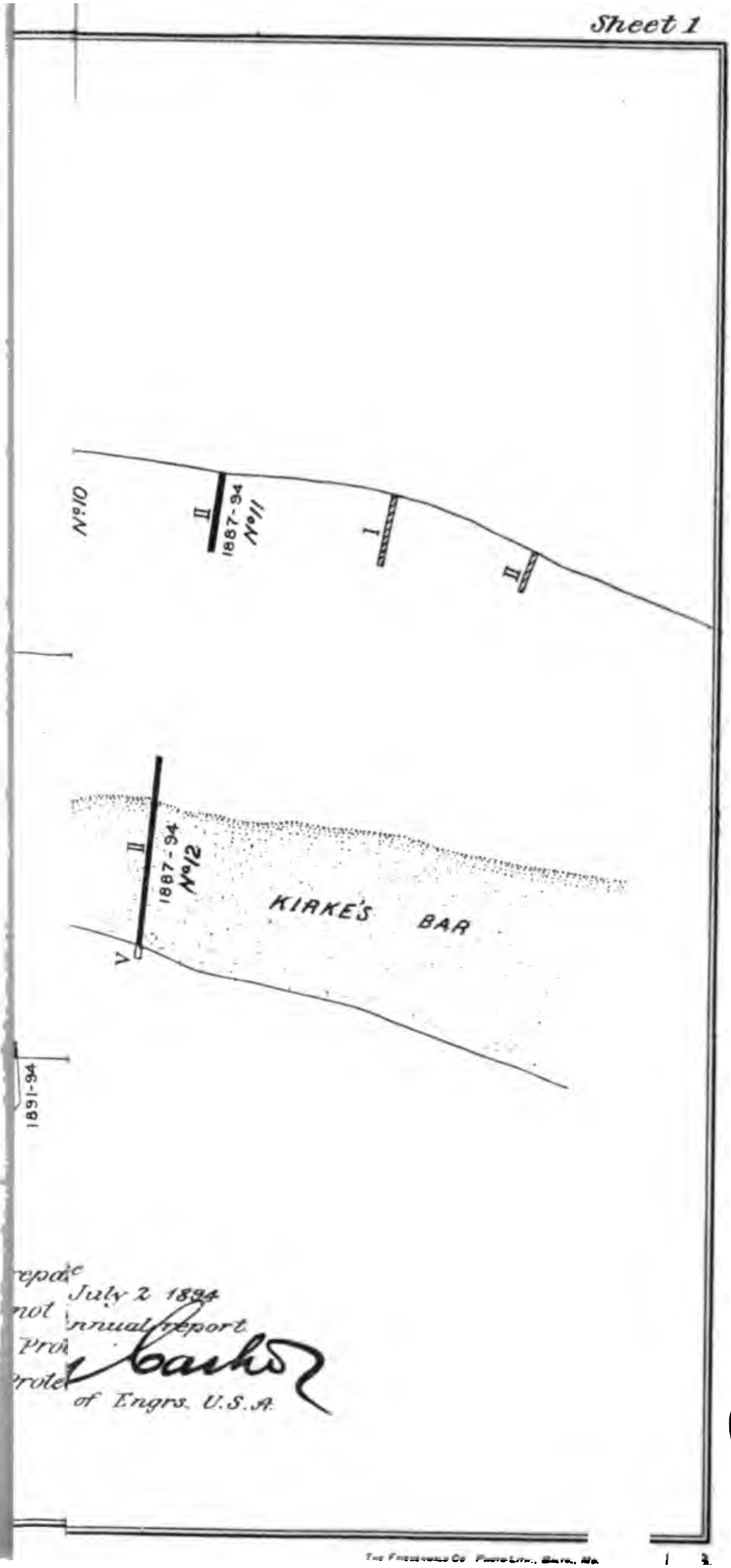
COMMERCE AND NAVIGATION.

A detailed statement of the sources whence the commerce of this river is derived, of its value, and of the probable effect of the completion of the works of improvement, is given in my report on the survey of the river, dated June 30, 1890, and printed as part of Appendix O 2, Annual Report of the Chief of Engineers for 1890.

Prior to the inauguration of the works of improvement the commerce of the river, especially in the way of through shipments, was unimportant, as the condition of the channel rendered navigation uncertain and unsafe.

The improvement of the river has been accompanied by a steady

Sheet 1



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increase in the volume of river traffic (especially in manufactured cotton goods from Augusta as through freight for exportation) and by a decrease in the rates of freights, both of which are more than commensurate with the expenditures involved. In fact, the annual commerce has increased at the rate of $10 for every dollar expended by the United States and the freight rates have been reduced about 20 per cent.

The exports from the river valley are mainly cotton, naval stores, lumber and wood, while the imports are fertilizer, camp and mill supplies, cotton ties and bagging, and manufactured articles. Two steamers are engaged in the river traffic, carrying annually about 37,000 tons of freight, valued at $3,700,000. In addition to the freights carried by the various steamers, the river valley affords logs, hewn and sawed timber, spars, and cord wood. The timber is rafted down the river. A large portion of the cord wood is lightered to Savannah, while the remainder is used as fuel by the river boats. The hard wood sawed and the staves and shingles split along the river are shipped to Savannah by boat. It is estimated that about 40,000 tons of logs, timber, and cord wood, valued at about $160,000, are annually rafted or lightered to Savannah and other places along the river. This makes the total annual shipments of the Savannah River 80,840 tons, valued at $3,850,725.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected fn 1893, $56,664.90. Forts Oglethorpe and Pulaski are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

Since the existing project for improving the Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (balance unexpended)	$19.91
September 19, 1890	25,000.00
July 13, 1892	35,000.00
Total	60,019.91

The total expenditures under the present project up to June 30, 1894, including all outstanding liabilities, were $56,756.94.

Money statement.

July 1, 1893, balance unexpended	$26,023.59
June 30, 1894, amount expended during fiscal year	22,730.67
July 1, 1894, balance unexpended	3,292.92
July 1, 1894, outstanding liabilities	29.95
July 1, 1894, balance available	3,262.97
Amount (estimated) required for completion of existing project	272,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. R. S. BURNETT, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 2, 1894.

CAPTAIN: I respectfully submit the following report of snagging operations on the Savannah River, between Savannah and Augusta, Ga., for the fiscal year ending June 30, 1894:

This portion of the Savannah River having been thoroughly snagged during the preceding fiscal year, it was not found necessary to resume work with the snag boat *Toccoa* until December 26. On that date operations were commenced immediately above Savannah and continued through to Augusta. The boat reached Augusta January 20 and left for Savannah on the 21st. This boat removed 283 snags and stumps; 14 logs on the banks were cut, and 348 overhanging trees were cut and removed from the banks of the river.

The river reached an extreme low-water stage in June. Steamboats reported low-water snags dangerous to navigation at several places, especially in the Seven Points. The snag boat *Satilla* left Savannah June 21 and arrived at Augusta June 25. Snagging work commenced at 14½ miles and continued until the end of the fiscal year to 30½ miles, removing 23 snags from the channel; 11 overhanging trees and 1 log were cut on the banks and removed.

All snags seriously obstructing the channel were removed. A total of 306 snags and stumps were removed and 15 logs on the bank were cut; 359 overhanging trees were cut and removed from the banks of the river.

No serious accident to steamboats or other craft has occurred on account of snag obstructions, but craft have been sunk and otherwise damaged by a lack of proper guide approaches to the draw channel through the Charleston and Savannah and the Port Royal and Augusta railway bridges.

The following wrecks at the various stages of water are dangerous to all craft plying the river; they also delay steamboats, wreck rafts and other floating craft:

At 14 miles, 100 piles and 3 flatboats.
At 19 miles, 1 barge in channel.
At 22 miles, steamer *Eclipse* in channel.
At 34½ miles, 1 barge in channel.
At 75 miles, steamer *Tallahmecha* in channel.
At 90½ miles, steamer *Hamburg* in channel.
At 116½ miles, 1 barge in channel.
At 116¾ miles, steamer *Edgefield* in channel.
At 137¼ miles, piling at obstructions, edge of channel.
At 156 miles, steamer *Wm. Lowndes* in channel.
At 175 miles, steamer *W. H. Starke* in channel.
At 188 miles, 1 barge in channel.
At 192 miles, 1 barge in channel.
At 200¾ miles, steamer *Hard Times* in channel.

These wrecks and obstructions should be removed at as early a date as practicable, as they greatly interfere with the through-freight commerce of the river, causing irregularity in the trips of the steamboats and failure in making connection with the steamers at Savannah.

With the United States plant now available these wrecks could be removed by hired labor and purchase of material in open market at a cost not to exceed $10,000; by contract, $50,000.

The commerce of the river is steadily increasing, especially in through freights.

Submitted with this report are the following statements:

(1) Summary of work done, by months.
(2) Summary of work done, by localities.
(3) Summary of work done from 1882 to 1894, inclusive.

Respectfully submitted.

R. S. BURNETT,
Assistant Engineer.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

1. *Savannah River, Georgia.—Summary of work done by months, 1893–'94.*

Months.	Total days worked.	Number of days removing obstructions.	Snags.* First class.	Snags.* Second class.	Snags.* Third class.	Stumps.	Overhanging trees. Pulled back.	Overhanging trees. Cut. Over 8 inches.	Overhanging trees. Cut. Under 8 inches.	Logs on bank cut.	Explosives used.
											Lbs.
January	20	17	38	137	66	20	......	187	102	14	103
June	10	3	10	7	6	......	......	5	6	1	......
Total	30	20	48	144	72	20	......	192	108	15	103

* First-class snags are more than 2 feet in diameter at butt, second-class snags are more than 8 inches in diameter at butt, third-class snags are under 8 inches in diameter at butt. All logs and trees under water are considered snags.

2. *Savannah River, Georgia.—Summary of work done, by localities, 1893–'94.*

Distance above Savannah, Ga.	Snags. First class.	Snags. Second class.	Snags. Third class.	Stumps.	Overhanging trees. Over 8 inches.	Overhanging trees. Under 8 inches.	Logs on bank cut.	Explosives used.
Miles.								*Lbs.*
14½	10	7	6	....	5	6	1	......
80½	....	2	3	1	......	5	....	......
92	....	3	6	2	2	5	2	3
96	1	3	2	1	12	6	....	......
101	2	3	3	1	14	10	....	......
106	1	4	2	....	......	......	....	......
112	2	5	4	....	......	......	....	......
115	2	6	....	2	10	......	....	......
118½	2	6	3	....	17	......	....	20
119½	5	12	4	....	2	......	3	......
122	2	12	6	1	......	......	1	......
124	1	3	1	2	3	......	2	......
126	1	8	3	2	5	......	....	......
133½	1	5	....	1	6	4	....	......
136	4	22	4	....	13	10	....	30
140¾	2	4	2	....	5	......	....	......
144	....	2	....	....	10	5	....	......
145	....	3	2	....	15	5	1	10
147½	2	.....	5	....	5	12	1	......
160	2	.....	5	....	15	24	2	20
173	1	2	....	1	......	......	....	......
180	1	3	....	....	10	1	....	......
181	1	4	2	....	......	......	....	......
182	1	5	2	1	10	......	....	10
185	2	7	2	2	21	......	2	......
190	1	3	....	....	5	3	....	10
194	1	5	2	....	......	......	....	......
196	....	5	1	1	......	......	....	......
197½	....	.....	2	2	7	12	....	......
Total	48	144	72	20	192	108	15	103

3. *Savannah River, Georgia.—Detailed statement of work done to date, 1882–1894.*

	Snags. First class.	Snags. Second class.	Snags. Third class.	Overhanging trees. Pulled back.	Overhanging trees. Cut. Over 8 inches.	Overhanging trees. Cut. Under 8 inches.	Steamboats.	Logs on bank cut.	Piles removed.	Explosives used.
										Lbs.
1882–1893 (Report Chief of Engineers, U.S. Army, 1893)		2,619			13,341		1	89	82	45
1893–'94		306			359		......	15	......	103
Total		2,925			13,700		1	104	82	148

COMMERCIAL STATISTICS.

Savannah River, Georgia, 1893-'94.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
Timber	43, 750	$175, 000	Fertilizers	3, 250	$75,000
Rosin	7, 300	73, 000	Corn	850	88,000
Turpentine	3. 550	177, 550	Cotton seed	260	5,250
Cotton	5, 700	977, 500	Passengers	985	18,775
Staves	2, 850	228, 000			
Merchandise	12, 345	2, 032, 700	Total	80, 840	3,850,775

N 3.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GEORGIA.

The Savannah River is formed by the junction of the Tugaloo and Keowee rivers, and flows in a southeasterly direction to the sea. Above the city of Augusta the river is navigable only by pole boats.

A detailed description of this river is given in my report of the preliminary examination and survey, printed as House Ex. Doc. No. 213, Fifty-first Congress, first session.

For a special history of past work, see p. 1032, Annual Report Chief of Engineers for 1888.

ORIGINAL CONDITION.

The Savannah River above the city of Augusta has a very steep slope, and the obstacles to navigation are not only very numerous and extensive, but at places quite dangerous. They consist of rock ledges, isolated bowlders, and bars of sand and gravel, with minimum low-water depths of less than 1 foot.

PLAN OF IMPROVEMENT.

The plan of improvement, as outlined in my report of January 31, 1890, provides for the establishment between Petersburg and The Locks of a downstream channel, 12 to 25 feet in width, and navigable during ordinary summer low water (or from nine to ten months of every year) for pole boats drawing 2 feet, and of an upstream channel navigable under the same conditions for pole boats drawing 1.3 feet of water.

This is to be obtained by (1) removing logs and overhanging trees; (2) excavating rock, sand, or gravel, and with excavated material raising crests of ledges; (3) constructing training walls to increase flow of water through sluices.

The cost of the improvement is estimated at $23,000, provided the money is all made available at once, or at $33,000, if supplied in smaller amounts.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

In 1881 work was begun at the rapids near Stevens Creek Falls, about 8 miles above Augusta. Since then operations have been carried on between that point and Ring Jaw, 34 miles above Augusta. The work done consisted in the removal of solid ledges of rock, bowlders, and gravel, and in the construction of wing dams for contracting the waterway. These dams were built of brush mattresses loaded with riprap stone, and in some instances of stone alone. In the execution of this work there were removed 4,572.5 cubic yards of rock, chiefly by blasting, 37 cubic yards of loose bowlders, and 62 cubic yards of gravel.

In the building of wing dams, a part of which was constructed of stone and a part of stone and brush, there were used 6,670 square yards of brush mattresses, 2,018.66 cubic yards of fascines, and 5,370.3 cubic yards of riprap stone. The river banks were cleared from Petersburg, Ga., to The Locks above Augusta, a distance of 48 miles.

Up to July 1, 1893, the total expenditures for the work, including outstanding liabilities, amounted to $9,956.64.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

The annual examination of the river was made.

CONDITION OF WORK JUNE 30, 1894.

The river banks are in good condition from The Locks, above Augusta, Ga., to Petersburg, Ga.

The channel is in good and navigable condition from The Locks, above Augusta, Ga., to Little River Shoals, 17½ miles above.

COMMERCE AND NAVIGATION.

A detailed statement of the commerce tributary to this river is given in my report on the examination and survey of the river, printed as House Ex. Doc. No. 213, Fifty-first Congress, first session.

The freight carried on the river consists principally of cotton, grain, fertilizers, and general merchandise. Its total value amounted last year to about $350,000, the freight receipts upon which amounted to about $30,000. With an improved pole-boat channel the commerce of the river could be considerably increased, but no work other than that necessary for the benefit of pole-boat navigation is needed.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1893, $56,664.90. Forts Oglethorpe and Pulaski are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

Since the existing project for improving this portion of Savannah River was adopted, one appropriation of $10,000 has been made, by act of Congress approved July 13, 1892.

The total expenditures under the present project up to June 30, 1894, including all outstanding liabilities, amounted to $10,000.

It is proposed to expend any funds which may become available during the year in removing ledges of rock and gravel and in constructing closure dams and training walls to increase the flow of water through the sluices.

The sum of $23,000 can be advantageously and economically expended during the coming year.

Money statement.

July 1, 1893, balance unexpended	$4,180.08
June 30, 1894, amount expended during fiscal year	4,180.08

Amount (estimated) required for completion of existing project	$23,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	23,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

N 4.

IMPROVEMENT OF DARIEN HARBOR, GEORGIA.

About 12 miles above the town of Darien the Altamaha River divides into several branches. The northerly main branch forms the Darien River. That portion of Darien River between Darien and Doboy Sound is known as Darien Harbor.

Operations for improving this harbor have been carried on in accordance with a project of improvement submitted to the Chief of Engineers by Gen. Gillmore, the officer then in charge, dated January 30, 1885, and printed as Appendix N 16, Annual Report of the Chief of Engineers for 1885.

ORIGINAL CONDITION.

Darien Harbor is at seven points, and covering a total distance of 9.7 miles, more or less obstructed by shoals with minimum low-water depths on them of from 6.4 to 10.6 feet. The reaches between these shoals have nowhere less than 12 feet depth at mean low water. The mean rise and fall of tide in the river is about 6.5 feet.

PLAN OF IMPROVEMENT.

The plan of improvement contemplates the establishment of a navigable channel between Darien and Doboy with a minimum low-water depth of 12 feet. This is to be accomplished by dredging to a minimum depth of 12.5 feet, and by the construction of wing dams at 5 of the shoals for maintaining the depth of the improved channel.

The estimated cost of the improvement is $170,000.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

Five of the shoals at Darien Harbor were temporarily improved by dredging, in 1879, by means of an appropriation of $8,000 made by act of Congress approved June 18, 1878.

The first work under the present project was done under a contract for dredging executed on May 5, 1891, with Mr. P. Sanford Ross. Work was begun on June 11, 1891, and continued until November 13, 1891, when the funds available for the work were exhausted. There were removed from the various shoals 86,640.20 cubic yards of material.

The construction of spur dams was begun on March 14, 1893, and continued until June 10, when the funds available for the work were exhausted. Of the 24 spur dams contemplated by the project for the improvement of the harbor there have been constructed 20, consisting each of two rows of piles filled with brush fascines and strengthened by timber waling, cross and back ties, and where required, by groups of tie piles and clusters of fender piles.

The aggregate length of the spur dams is 4,172.6 feet, and there were used in their construction and for the tie and fender piles 1,200 piles, 15,068.35 cubic yards of brush fascines, 59,290.25 feet, B. M., of 6 by 10 inches sawed timber, and 6,094.46 pounds of iron bolts.

Up to July 1, 1893, the total expenditures for the work, including all outstanding liabilities, amounted to $49,546.68.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30. 1894.

The annual examination was made in June, 1894.

CONDITION OF WORK JUNE 30, 1894.

On two of the spur dams at North and South Reach the fender piles have been damaged, and on many of them the brush has either settled or been partially carried away, so that a refilling of the pile work with brush and stone will be required. The works at Pico Cut and Long Reach are in good condition. No change has taken place in the channel depth in North and South Reach, the 9-foot mean low-water curve remaining continuous across the shoal. Slight shoaling has taken place in Long Reach, but the 9-foot curve remains continuous over both shoals in this reach.

COMMERCE AND NAVIGATION.

The commerce of Darien is entirely dependent upon water carriage. It consists principally of shipments of lumber, timber, naval stores, and rice, which are brought down the Altamaha River from the region bordering that river and its tributaries. But little cotton seeks an outlet at this port. The total annual trade amounts to about 125,000 tons, valued at $1,500,000, the freight on which is about $600,000.

The outlet of Darien Harbor is by way of Doboy and Doboy Bar, but the shoaling of the latter renders the entrance of deep-draft vessels impossible, and much of the timber that would otherwise be shipped from Darien is now rafted to Sapelo and St. Simons, at an increased cost of about 25 cents per 1,000 feet. These shipments, amounting annually to about 20,000,000 feet, are not included in the Darien exports, although it all passes through the harbor.

There is also a large number of small sailing craft carrying rice, fish, vegetables, etc., plying on the inland waters around Darien, and on the inland route there are two steamers per week to Savannah, one per week up the Altamaha River, and the Empire Mills Company has a steamer running regularly to Brooklyn, N. Y., carrying lumber, returning with cargoes of general merchandise.

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. Amount of duties collected in Brunswick in 1893, $5,768; at Darien, none. Sapelo Light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

Since the existing project for improving Darien Harbor was adopted the following appropriations have been made for this work:

September 19, 1890	$25,000
July 13, 1892	25,000
Total	50,000

The total expenditures under the present project of improvement to June 30, 1894, including all outstanding liabilities, were $50,000.

It is proposed to expend the funds on hand and any that may become available during the year in the removal of the shoals by dredging and in the construction of works of contraction in accordance with the existing project.

The sum of $120,000 can be economically and advantageously expended during the coming year.

Money statement.

July 1, 1893, balance unexpended	$557.44
June 30, 1894, amount expended during fiscal year	557.44
Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	120,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1, 1875, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	77	28,053	647				92	47,600	1,198	169	75,663	1,845
1876	65	23,105	611				124	70,368	1,897	189	93,473	2,508
1877	104	24,827	1,257	3	674	22	99	50,913	1,231	206	106,414	2,510
1878	61	29,264	641	2	1,051	20	126	60,109	1,628	189	90,424	2,289
1879	58	23,275	487	3	4,199	25	115	57,710	1,407	176	82,184	1,919
1880	66	21,539	489	1	688	13	134	68,072	1,608	201	90,270	2,140
1881	101	40,619	849	3	1,220	29	162	84,457	1,991	166	126,295	2,869
1882	117	48,208	909	1	455	9	90	51,421	1,155	208	100,082	2,163
1883	95	38,173	815				93	49,290	1,135	188	87,963	1,950
1884	81	34,412	714	2	606	16	92	50,178	1,133	175	85,193	1,863
1885	78	27,763	691	2	652	16	80	42,587	975	160	71,002	1,673
1886	108	44,389	852				42	20,772	483	150	65,161	1,335
1887	127	57,035	1,059	5	2,349	45	26	13,023	298	158	72,407	1,402
1888	185	76,645	1,558	1	402	9	22	13,423	273	208	91,470	1,840
1889	145	69,763	1,341	7	4,349	62	61	19,837	453	213	93,949	1,856
1890	169	58,058	1,158	5	1,964	41	28	10,860	308	202	70,222	1,507
1891	137	56,818	1,124	6	2,377	46	24	17,853	308	167	77,048	1,478
1892	168	69,627	1,369	1	353	7	25	17,446	334	194	87,426	1,710
1893	134	58,310	1,076	4	1,918	33	33	31,417	486	171	91,640	1,595

CLEARED.

1875	22	12,214	328	11	4,055	97	104	55,759	1,372	137	72,028	1,797
1876	39	9,300	270	4	1,553	32	180	87,489	2,263	223	98,342	2,565
1877	44	13,209	314	4	842	21	169	92,795	2,154	217	106,846	2,489
1878	28	7,842	181	6	3,000	62	149	83,385	1,947	183	94,236	2,190
1879	40	14,052	301	7	2,765	57	125	65,433	1,538	172	82,250	1,896
1880	55	17,076	393	7	3,589	72	168	84,172	2,016	230	194,837	2,481
1881	80	28,492	617	8	3,120	70	184	95,353	2,164	272	126,965	2,851
1882	93	34,098	709	6	1,962	46	5	63,525	1,434	214	99,585	2,189
1883	66	25,019	510	9	3,533	72	108	56,411	1,340	183	84,963	1,931
1884	59	20,637	457	11	3,977	85	19	60,337	1,478	189	90,951	2,020
1885	46	16,649	339	8	3,354	62	98	52,742	1,198	152	72,745	1,599
1886	93	38,295	719	10	3,682	80	50	24,376	564	153	66,358	1,362
1887	126	55,592	1,016	12	1,144	17	6	8,612	189	144	65,700	1,222
1888	155	64,749	1,318	2	538	15	36	23,742	453	193	89,029	1,786
1889	155	63,347	2,091	6	4,333	66	46	26,488	528	207	94,168	2,685
1890	171	58,810	1,174	3	962	23	31	15,569	336	205	75,351	1,533
1891	127	53,890	1,031	3	896	20	26	18,006	256	156	72,792	379
1892	161	69,488	1,310	2	917	16	33	21,502	418	196	91,807	1,744
1893	137	56,297	1,115	1	300	6	46	40,150	630	184	96,747	1,751

r shipments from port of Darien, Ga., from January 1, 1875, to December 31, 1893.

'ear.	Foreign.		Coastwise.		Total.	
	Superficial feet.	Value.	Superficial feet.	Value.	Superficial feet.	Value.
....	41,447,024	$557,524	10,992,600	$181,377.00	52,439,624	$738,901.00
....	60,762,000	735,099	8,370,000	138,105.00	69,132,000	873,204.00
....	64,378,000	776,856	11,888,100	196,153.65	76,266,100	973,009.65
....	59,697,124	716,365	7,057,800	116,453.70	66,754,924	832,818.70
....	47,217,818	566,613	12,646,800	208,672.20	59,804,618	775,285.20
....	74,612,520	895,350	15,368,500	253,578.60	89,981,020	1,148,928.60
....	65,420,876	785,050	25,642,800	423,106.20	91,063,676	1,208,156.20
....	36,639,379	439,672	30,688,200	506,355.30	67,327,579	946,027.30
....	42,385,000	508,620	22,517,100	371,532.15	64,902,100	880,152.15
....	50,656,000	607,872	18,573,300	306,459.45	69,229,300	914,331.45
....	40,101,000	501,262	14,984,100	247,937.65	55,085,100	749,199.65
....	19,960,000	219,500	24,465,000	661,440.00	54,425,000	870,940.00
....	12,023,611	138,476	50,349,600	912,220.00	62,373,211	1,056,960.00
....	17,975,371	215,705	65,998,200	1,121,960.00	83,975,571	1,337,665.00
....	20,772,265	237,652	50,667,660	760,144.00	71,449,865	997,816.00
....	10,962,017	140,746	68,223,683	949,762.00	79,185,700	1,090,508.00
....	13,785,333	274,674	45,519,707	910,718.10	59,305,040	1,185,391.80
....	12,893,730	179,616	49,708,879	1,093,595.00	62,602,609	1,273,211.00
....	33,300,000	399,600	41,375,100	827,502.00	74,675,100	1,227,102.00

Commerce.

Year.	Value of exports.	Value of imports.	Total collections.
....	$1,621,904	$5.600	$11,806.72
....	1,137,490	3,356	18,980.02
....	1,073,008	1,025	11,254.19
....	969,834	2,334	11,067.37
....	1,038,185	11	9,688.20
....	860,500	....	2,359.01
....	1,037,330	....	....
....	1,221,000	....	....
....	2,100,000	2,600	964.13
....	907,816	None.	None.
....	140,746	None.	None.
....	1,530,000	None.	None.
....	1,452,827	None.	None.
....	1,406,718	None.	None.

R. W. Grubb,
Deputy Collector, Darien, Georgia.

ɩt. O. M. Carter,
Corps of Engineers, U. S. A.

N 5.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

ıe Altamaha River is formed by the junction of the Oconee and ulgee rivers, in the southeastern part of Georgia, and flows in a heasterly direction to the sea.

detailed description of this river is given in my report of a survey d June 12, 1890, which is printed as part of Appendix O 5, ual Report of the Chief of Engineers for 1890, pp. 1327-1386.

ɩr a special history of past work see p. 1038, Annual Report of ·hief of Engineers for 1889 and the Annual Reports of the same ɜr since that date.

ORIGINAL CONDITION.

The chief obstruction to the navigation of the Al[illegible]ha River consists in rock ledges, sand bars, overhanging trees, snags, and sunken logs. The rock ledges were confined to the upper portion of the stream, while the other obstructions were found throughout its entire course. The low-water depths at some points did not exceed 1 foot.

PLAN OF IMPROVEMENT.

The plan of improvement outlined in my report of June 12, 1890 provides for the establishment of a navigable steamboat channel, 3 feet deep at ordinary summer low water, between the junction of the Oconee and Ocmulgee rivers and the town of Darien.

This is to be accomplished by (1) removing rock shoals and sand bars; (2) building deflecting dikes and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream; (4) revetting caving banks.

The cost of the improvement is estimated, in round numbers, at $129,000, provided funds are regularly and adequately supplied.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

The first appropriation ($5,000) ever made for the Altamaha was expended on a snag boat, which was built for use upon this river and the Savannah. This boat began to work upon the river on October 1, 1893, and has been employed at intervals since that date, regular work having been impossible on account of the insufficiency of funds. She was thoroughly repaired in 1889. Operations have been carried on between Darien and the junction of the Oconee and Ocmulgee rivers. There have been removed in all 2 piles, 1,847 snags and stumps, and 4,944 overhanging trees; 26 logs were cut upon bank and 5 trees were deadened.

In 1883 channels 100 feet in width and 4 feet in depth at ordinary low water were opened through the rock ledges at Town Bluff and Piney Bluff by the removal of 319 and 1,480 cubic yards of rock at those points respectively.

In 1884–'85 a training wall was built at Beards Bluff for the improvement of a shoal at that locality, and shore protection was constructed for the protection of caving banks. In the execution of this work 811.2 cubic yards of stone, 428.44 cubic yards of gravel, and 3,545.38 cubic yards of brush fascines were used.

In 1893 the construction of a training wall and spur dams was begun at Coupers Bar, and was continued until the funds available for this purpose were exhausted. There were used in this work 141.51 cubic yards of riprap stone, 4,390.11 cubic yards of brush fascines, 556 piles, 12,502.25 feet, B. M., of 6 by 10 inch timber, and 1,285.40 pounds of iron bolts. All of the above work, with the exception of that done by the snag boat, was done by contract.

The steam hoister, rigged as a pile-driver, began work October [illegible], 1891, at Beards Bluff, with the construction of wattled pile spur dams and the repair of the old training wall built at that point. Operations were suspended at the end of January, 1892, owing to the high water, but were resumed May 5, and continued at Beards [illegible]uff and Marrowbone Bar until October 25, 1892, when the steam ho[illegible]er was sent to Savannah for repairs. In this work there were driven [illegible]82 piles, 3,1[illegible] linear feet of piling were wattled with poles, 2,462 [illegible]are yards and

1,630 cubic yards of brush mattresses were sunk and covered with 371 cubic yards of riprap stone.

The work of the snag boat and the steam hoister was done by hired labor and purchase of material in open market.

The total expenditures up to July 1, 1893, including outstanding liabilities, amounted to $26,406.64.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

Snagging operations were continued by the snag boat *Toccoa* until September 1, when she was sent to the Oconee River. During this time there were removed from the channel 342 snags and stumps and 4,533 overhanging trees; 5 logs were cut up and removed on bank. The snag boat also removed the wreck of the steamer *Tar Heel*, which was lying in the channel at Oswells Cut.

The steam hoister, rigged as a pile-driver, began work on the river on July 5 and continued until September 1, when operations had to be suspended on account of high water. During this time she was engaged in driving fender piles at the ends of jetties at Beards Bluff and in removing rock from the channel at Town Bluff Shoal. There were driven 66 fender piles, and the same were cut off 6 feet above low water. There were blasted and removed from the channel 45 cubic yards of solid rock, and there were used 59½ pounds of explosives.

All work during the year was done by hired labor and purchase of material in open market.

CONDITION OF WORK JUNE 30, 1894.

The training wall at Coupers Bar is in good condition, but almost all of the brush has been washed out of the spurs, in consequence of which the works have failed to hold the depth obtained across the bar. Refilling of the pile spur dams with brush and stone is required, as well as the construction of the remaining works contemplated by the approved project.

The works at Beards Bluff are in good condition, and a depth of 4½ feet at summer low water is maintained over the bar.

The works at Marrowbone Bar are in good condition, and a depth of 5 feet at summer low water is maintained over the bar.

COMMERCE AND NAVIGATION.

The commerce passing over the Altamaha River is derived not only from the region bordering it, but also from the country bordering its tributaries, the Ocmulgee and the Oconee rivers.

About one-half of the counties bordering the Altamaha River are wholly dependent upon the river for transportation, while the remainder are served in part by two railroads, the East Tennessee, Virginia and Georgia, running approximately parallel to the river on its southern side at an average distance of about 15 miles from it, and the Savannah, Florida and Western, crossing the river at Doctortown at about right angles to its general direction. The territory dependent upon the river for the transportation of its produce and supplies is composed of one-third of the counties of Appling, Wayne, Glynn, and all of Tatnall and McIntosh.

The commerce of the river during the past twelve months is estimated at 290,115 tons, valued at $3,591,975; an increase of 95,294 tons as compared with the year before. This increase is due to a revival in the naval-stores business and to a natural increase in the amount of hard wood handled on the river.

The following boats were engaged in traffic on this river during the past fiscal year, viz: The *Americus*, the *Altamaha*, and the *Swan*, discharging their freight at Doctortown, whence it is taken by rail to Savannah; and the *Louisa*, running from Abbeville to the Florida Central and Peninsular Railroad bridge, at which latter place the railroad company is now preparing to construct wharves and sheds for the accommodation of the river trade.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1893, $5,768. Sapelo Light is the nearest light-house, and forts Oglethorpe and Pulaski are the nearest forts.

Since the existing project for improving Altamaha River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$223.41
September 19, 1890	15,000.00
July 13, 1892	15,000.00
Total	30,223.41

The total expenditures under the present project to June 30, 1894, including all outstanding liabilities, were $29,529.88.

It is proposed to expend the funds on hand and any that may become available during the present fiscal year in the removal of obstructions and in the improvement of the shoal places in the river according to the revised project of 1890.

The sum of $50,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every freshet stage. They should, however, diminish in number from year to year. From $3,000 to $5,000 will be required for the annual maintenance of the completed work. The work of removing obstructions has been under the local charge of Mr. R. S. Burnett, assistant engineer, whose report is appended hereto.

Money statement.

July 1, 1893, balance unexpended	$4,214.[illegible]
June 30, 1894, amount expended during fiscal year	3,521.[illegible]
July 1, 1894, balance unexpended	693.[illegible]
Amount (estimated) required for completion of existing project	99,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. R. S. BURNETT, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 2, 1894.

CAPTAIN: I respectfully submit the following report on the improvement of the Altamaha River, Georgia, during the fiscal year ending June 30, 1894:

Snagging operations were continued by the snag boat *Toccoa* to September 1. There were removed from the channel of the river between Doctortown and the Forks 324 snags and 18 stumps; 4,533 overhanging trees were cut; 5 logs on the banks were also removed. The snag boat *Toccoa* also removed the wreck of the steamer *Tar Heel*, which was directly in the channel at Oswells Cut.

U. S. steam hoister No. 1.—Work was commenced by the hoister July 5. The boat was employed in driving fender piles at the ends of jetties at Beards Bluff, and in drilling, blasting, and removing rock from the channel at Town Bluff Shoals. There were driven 66 fender piles and the same cut off 6 feet above low water; 74 linear feet of holes were drilled, and 37 charges of dynamite were exploded, removing 45 cubic yards of solid rock from the channel. This latter work was suspended September 1 on account of high water.

The general condition of the river is now good, but snag work is necessary.

One new line of steamboats has been established between Abbeville, Ga., and the crossing of the Florida Central Peninsular Railroad, at Barrington, Ga. The railroad company is now putting in wharves and side tracks to accommodate the new line of boats.

No serious accidents have occurred to craft plying the river. There has been no suspension of navigation.

The stage of water in June, 1894, was 1½ feet below summer low-water stage, and, notwithstanding this unusual condition of the river, the steamboats run with regularity.

The contracting jetties at Beards Bluff are in good condition and they maintain a depth of 4½ feet at a summer low-water stage.

At Marrowbone Bar the 12 jetties contracting the channel and the 6 closing dams are all in good condition. A depth of 5 feet at a summer low-water stage in the channel through this bar has been obtained. Some very slight repair work will be necessary to two of these dams within the next six months.

The commerce of the river has increased to the extent of 95,294 tons, due to the regularity of steamboats navigating the river, to the revival in the naval stores business, and also to the recent development of hard-wood shipments.

Submitted with this report are the following papers:

(1) Summary of work done, by months.

(2) Summary of work done, by localities.

(3) Summary of work done from 1883 to 1894.

Respectfully submitted.

R. S. BURNETT,
Assistant Engineer.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

1. Altamaha River, Georgia.—Detail statement of work done to date, 1883–1894.

	Jetties constructed.		Sloughs closed.		Snags.			Stumps.	Overhanging trees.			Trees girdled.	Logs on bank cut.	Piles driven.
					First class.	Second class.	Third class.		Cut. Over 8 inches.	Cut. Under 8 inches.	Pulled back.			
	No.	*Lin. ft.*	*No.*	*Lin. ft.*										
1883–1893 (Report of Chief of Engineers, U. S. Army, 1893)	22	2,759.2	6	237	218	1,078	524	27	1,751	2,272	921	5	26	482
1893–'94	....	....	....	....	49	207	68	18	1,727	2,806	......	...	5	66
Total	22	2,759.2	6	237	267	1,285	592	45	3,478	5,078	921	5	31	548

	Piles cut off.	Piles removed.	Stone quarried and transported.	Wattle work constructed.	Bank protection constructed.	Brush used in mats.	Rock removed.	Explosives used.	Holes drilled.	Charges exploded.	Wrecks removed.	Stone placed on work.	Mat 18 feet wide constructed.
			Tons.	*Lin. feet.*	*Lin. feet.*	*Cu. yds.*	*Tons.*	*Lbs.*	*Lin. ft.*			*Cu. yds.*	*Lin. feet.*
1883–1893 (Report of Chief of Engineers, U. S. Army, 1893)	470	2	371	3,166	79	3,276	1,799	163	....	......	....	......	......
1893–'94	66	....	......	80	......	15	45	59½	74	37	1	......	......
Total	536	2	371	3,246	79	3,291	1,844	2,22½	74	37	1	5	20

The stage of low water 6 inches below zero mark 1894.

2. Altamaha River, Georgia.—Summary of work done by months, 1893–'94.

Month.	Holes drilled.	Linear feet drilled.	Charges exploded.	Solid rock removed.	Length, width, and depth of cut.	Explosives used.	Piles driven.	Piles cut off.	Brush cut and used.	Mat, 18 feet wide, constructed.
				Cu. yds.					*C. yd.*	*Lin. ft.*
July	37	74	37	45	100×50×3½	19½	66	66	15	[illegible]
August	......	......	......	......	......	......	......	......	......	......
Total	37	74	37	45	100×50×3½	19½	66	66	15	[illegible]

Month.	Wattle constructed.	Poles cut.	Stones placed in work.	Explosives used.	Snags.			Stumps.	Overhanging trees cut.		Wrecks.
					First class.	Second class.	Third class.		Over 8 inches.	Under 8 inches.	
	Lin. ft.		*Cu. yds.*	*Lbs.*							
July	80	100	5	4	28	135	56	14	736	795	....
August	......	......	......	36	21	72	12	4	991	2,011	1
Total	80	100	5	40	49	207	68	18	1,727	2,806	1

3. Altamaha River, Georgia.—Summary of work by localities, 1893–'94.

Distance below forks.	Snags.			Stumps.	Wrecks.	Overhanging trees removed.		Explosives used.
	First class.	Second class.	Third class.			Over 8 inches.	Under 8 inches.	
Miles.								*Lbs.*
2¼	....	....	....	1	....	......	......	4
4¼	....	9	1	....	....	57	275	......
4⅓	....	13	5	4	....	......	......	......
5	2	3	1	....	....	......	......	......
8	1	....	1	....	....	2	90	......
13	....	13	5	1	....	......	......	......
14	2	16	7	....	....	37	71	......
14¼	3	11	14	1	....	......	42	......
15	2	7	1	....	....	20	110	......
16	....	2	....	....	....	130	170	......
19	1	9	3	1	....	......	103	......
23	1	5	....	....	....	......	......	......
26	4	10	3	....	....	5	100	......
27	1	2	....	....	....	......	......	......
28	1	3	....	....	....	110	122	......
29	7	1	2	1	....	......	......	......
31	....	10	4	1	....	......	......	......
33½	4	3	4	1	....	1	3	......
34	....	7	....	4	....	120	......	......
38½	2	3	....	....	....	120	......	......
42	2	4	1	....	....	108	60	......
42¼	1	4	4	....	....	64	50	......
46	2	1	....	....	....	149	......	......
48	1	5	2	....	....	140	136	[illegible]
48¼	....	4	1	....	....	99	172	......
49¾	....	5	....	....	....	125	243	......
50¾	....	10	....	....	....	59	100	[illegible]
64½	2	7	....	1	....	......	......	[illegible]
71½	1	3	6	....	....	138	290	[illegible]
71¼	....	10	....	....	1	......	......	......
71⅝	2	2	3	....	....	3	......	......
72¼	....	1	....	1	....	240	210	......
75	3	10	....	....	....	......	379	......
76	4	14	....	1	....	......	100	......
Total	49	207	68	18	1	1,727	2,806	[illegible]

COMMERCIAL STATISTICS.

Commercial statistics, Altamaha River, Georgia, 1893–'94.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
Timber	175,000	$710,000	Fertilizers	1,100	[illegible]
Rosin	80,600	806,400	Corn	1,780	[illegible]
Turpentine	16,900	845,000	Cotton seed	1,000	[illegible]
Cotton	650	125,000	Passengers	545	[illegible]
Staves	10,000	650,000			
Merchandise	2,500	265,000	Total	290,115	[illegible]

List of steamboats plying the Altamaha River, 1893–'94.

Name.	Draft, light.	Tonnage, registered.	Terminal points.
	Inches.		
Americus	24	229.35	Doctortown and Darien.
Altamaha	17	219.27	Doctortown and Town Bluff.
Swan*	18	360.00	Doboy, Doctortown, and Abbeville.
Louisa	20	220.00	Abbeville and Florida Central and Peninsular Railroad.

*Sunk near Abbeville and removed from channel by U. S. snag boat *Satilla*, as an obstruction to navigation.

N 6.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

The Oconee River rises in the northeastern part of Georgia, flows in a southeasterly direction, and unites with the Ocmulgee to form the Altamaha. A detailed description of this river is given in my report of the preliminary examination and survey, printed as House Ex. Doc. No. 211, Fifty-first Congress, first session. For a special history of past work, see p. 1253, Annual Report of the Chief of Engineers for 1889.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with low-water depths of not more than 2 feet. The chief obstructions to navigation consist of sand bars, rock shoals, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The plan of improvement, as outlined in my report of February 5, 1890, provides for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water from Milledgeville to the river's mouth.

This is to be accomplished by (1) removing rafts, rock shoals, and sand bars; (2) enlarging portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement is estimated at $171,000, provided funds are regularly and adequately supplied.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

Between 1812 and 1842 about $45,000 were expended by the State of Georgia in the improvement of this river, and between 1874 and 1875 about $8,575 were expended by the Oconee Steamboat Company between Dublin and the Central Railroad bridge, a distance of 28 miles. Operations under the project adopted in 1878 were begun in 1878, and have been carried on at irregular intervals ever since, as the available funds allowed. A specific appropriation of $1,500 for improving the section of river between Skull Shoals and the Georgia Railroad bridge was expended so as to give a least depth in that reach of 20 inches at extreme low water.

In all there have been removed from the river 7,300 snags and stumps, 34,710 overhanging trees, 490 cubic yards of rock; 670 trees have been deadened, 536 logs cut up on bank, and 366.5 cords of drift material cut up. Much work was done at Sweeneys Cut, which was filled up with logs, stumps, trees, two rafts, two lattice bridges, and a bridge trestle; 600 cubic yards of stone were quarried and placed in a closing dam at Fish Trap Cut, and 657 pounds of explosives were used.

The work at Old Boat Yard was completed. There were driven at this place 165 piles; 935 linear feet of piling were wattled, and 991 linear feet of brush mattresses 18 feet wide were sunk and covered with stone. In addition 13 snags and stumps were removed, and the banks at the ends of the dam were protected with brush and stone.

The work of building a new snag boat, the *Satilla*, under contract with Messrs. M. A. Sweeney & Bro., was completed October 3, 1891.

Up to July 1, 1893, the total expenditure for the work, including all outstanding liabilities, was $33,264.15.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

Snagging operations were continued by the snag boats *Toccoa* and *Ocmulgee*, the former working from September 1 to October 14, and the latter working from the beginning of the fiscal year to June 2, when the available funds were exhausted. During this time there were removed between the mouth and Milledgeville 6,819 snags and stumps, 5,672 overhanging trees, and 266⅔ cubic yards of gravel, clay, and sand; 503 logs were cut up on bank, 8 trees were girdled, and 966 pounds of explosives were used.

From September 1 to September 4 the steam hoister, rigged as a pile-driver, was engaged in repairing the jetties at Old Boat Yard. In this work there were used 20 linear feet of brush mattresses 18 feet wide, 15 cubic yards of brush fascines, and 5 cubic yards of riprap stone; 11 piles were driven and 80 linear feet of pile work were wattled; 165 pounds of explosive were used.

CONDITION OF WORK JUNE 30, 1894.

A fairly navigable low-water channel has been opened from the mouth to Milledgeville. Further construction of jetties on the sand shoals, rock excavation, and a large amount of snagging will, however, be required before steamboats can run with regularity and safety.

The improvement made to date has been of great benefit to the section of country between the Central Railroad bridge and Milledgeville. One new line of steamers has been established above the bridge. The hard wood bordering on the river is now being cut and transported. Sawmills and manufactories of hard wood are being established.

In view of the information collected, it is estimated that the commerce on the river after improvement will amount to three times its original value.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1893, $5,768. Sapelo light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

Since the existing project for improving the Oconee River was adopted the following appropriations have been made for this work:

By act of Congress of—

August 11, 1888 (unexpended balance)	$201.18
September 19, 1890	25,000.00
July 13, 1892	25,000.00
Total	50,201.18

The total expenditures under the present project to June 30, 1894, including all outstanding liabilities, were $49,366.84.

As outlined in my project of February 5, 1890, it is proposed to expend the available funds, and any funds that may become available during the year, in the removal of obstructions and in the improvement of the shoals in the river between Milledgeville and the mouth.

The sum of $50,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every high-water season. They should, however, become fewer in number each year. From $1,000 to $5,000 will be required for the annual maintenance of the completed work. The work of removing obstructions has been in the local charge of Mr. R. S. Burnett, assistant engineer, whose report is appended hereto.

COMMERCE AND NAVIGATION.

The Oconee River is navigable from the mouth to Milledgeville, a distance of 147 miles. The following boats were engaged in the river traffic during this year:

List of steamboats plying the Oconee River, Georgia, 1893-'94.

Name.	Draft, light.	Tonnage, registered.	Terminals.
	Inches.		
R. C. Henry	14	140	Dublin and Ocmulgee Depot.
Louisa	20	220	Red Bluff and Dublin.
Lumber City	22	336.7	Ocmulgee Depot and Red Bluff.
Gypsie	20	70	Dublin.
Mary Elizabeth	32	4.5	
Swan	18	360	Dublin and Doboy.
Annie Gorbult	18	160	Dublin and Milledgeville.
Total		1,431.2	

During the last year these boats carried about 27,000 tons of freight, valued at about $1,240,000. The freights consist of rosin, turpentine, cotton, staves, guano, corn, cotton seed, and general merchandise. In addition to the freights carried by the steamers there were about 88,000 tons of timber drifted down the river, valued at about $440,000. The total commerce of the river during the last year was 115,271 tons, valued at $1,680,625, an increase of nearly 20,000 tons in weight and nearly $400,000 in value as compared with the preceding year.

With a continuation of the improvement now in progress to Milledgeville, new lines of boats will be established and through freights carried to the coast; the valuable hard-wood timber of the swamps will be developed and a large section of farming land will be made accessible throughout the year to a market reached by cheap river transportation.

In the counties bordering the Oconee River the population is about 90,000, the area of cultivated lands about 507,000 acres, and the value of all property from $10,000,000 to $11,000,000. The area tributary to the river is about 1,900 square miles.

Money statement.

July 1, 1893, balance unexpended	$17,162.43
June 30, 1894, amount expended during fiscal year	16,231.84
July 1, 1894, balance unexpended	930.59
July 1, 1891, outstanding liabilities	96.00
July 1, 1894, balance available	834.59
Amount (estimated) required for completion of existing project	121,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. R. S. BURNETT, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 2, 1894.

CAPTAIN: I respectfully submit the following report on the improvement of the Oconee River, Georgia, for the fiscal year ending June 30, 1894.

The snag boat *Ocmulgee* continued operations, removing snags from the channel between the Central Railroad bridge and Milledgeville, until March 12, when the boat commenced operations below the Central Railroad bridge, from Dublin, Ga., to the bridge. Work was suspended on June 7 on account of lack of funds to continue. The boat was tied to the bank at Balls Ferry (102½ miles) and placed in charge of a watchman; the crew were discharged.

The snag boat *Toccoa*, on September 1, commenced operations on the river, removing snags, and continued at work between the mouth of the river and Dublin until October 14, when it left for Savannah.

The snag boat *Ocmulgee* removed between 107¾ miles (Central Railroad bridge) and 147 miles (Milledgeville), 4,572 snags and 365 stumps; 402 logs on the bank were cut and removed; 1,461 overhanging trees were also cut and removed; 4 trees were girdled and 14 trees pulled back; 222 pounds of explosives were used.

Below the Central Railroad bridge (between 72 miles and 107¾ miles) the snag boat *Ocmulgee* removed 1,181 snags and 60 stumps from the channel; 450 pounds of explosives were used; 9,824 overhanging trees and 16 logs on the banks were cut and removed; 4 trees were girdled.

The snag boat *Toccoa* removed from the channel, from the mouth of the river to Dublin, 292 snags and 42 stumps; 3,212 overhanging trees and 85 logs were cut and removed from the banks; 266⅜ cubic yards of gravel, clay, and sand were removed at 137¾-miles shoal; 294 pounds of explosives were used.

Old Boat Yard jetties.—On September 1 the steam hoister commenced operations, making repairs to jetties; 11 fender piles were driven to an average depth of 14 feet; 20 linear feet of mattresses 18 feet wide were constructed and sunk at the end of the jetties, to prevent scouring; 5 cubic yards of riprap stone were quarried and placed in the work. Eighty linear feet of wattle work were constructed; 15 pounds of explosives were used. The steam hoister left for the Altamaha River September 4.

The work done has opened a fairly navigable channel at low water from the mouth of the river to Milledgeville.

A large amount of snag work is yet necessary, as well as excavation of rock at the rock shoals, and contracting jetties on the sand shoals, before steamboats can run with regularity and safety.

The improvement made to date has been of great benefit to the section of country between the Central Railroad bridge and Milledgeville. One new line of boats has been established above the bridge. The hard wood bordering the river is now being cut and transported. Sawmills are being established, as well as manufactories of hard wood.

The commerce of the river is steadily increasing; manufactories of hard wood are being established at Dublin. The shipments of hard wood and merchandise have been increased very largely. The total increase of commerce during the past year was 19,751 tons.

The following statements accompany this report:

(1) Summary of work by localities.
(2) Summary of work by months.
(3) Detailed statement of work done to date.

Respectfully submitted.

R. S. BURNETT,
Assistant Engineer.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

1. Oconee River, Georgia.—Summary of work by localities, 1893–'94.

Distance above "Forks."	Snags.			Stumps.	Overhanging trees.			Trees girdled.	Logs on bank cut.	Explosives used.
	First class.	Second class.	Third class.		Pulled back.	Cut. Over 8 inches.	Cut. Under 8 inches.			
Mls.										*Lbs.*
37	2	19	31	...	...	308	458	...	1	10
37¼	14	21	28	...	...	3	14	...	...	...
37½	7	46	58	...	...	187	524	...	...	...
37¾	11	14	7	...	...	381	420	...	3	...
38	21	44	8	17	...	382	105	...	5	328
38½	4	8	1	1	...	176	255	...	...	...
41	10	21	57	5	...	12	4	...	...	...
72¾	6	53	23	5	...	...	3	...	1	...
81	4	2	2	...	...	...	...	...	2	...
82	5	7	3	...	...	...	...	...	...	...
83	...	...	...	...	...	45	20	...	...	...
84	...	...	...	...	...	55	35	...	...	...
86	...	...	...	...	...	15	10	...	2	...
88	2	7	4	...	...	28	25	...	...	...
88¼	2	13	11	...	...	38	10	...	...	...
88¾	7	52	15	...	...	37	34	...	...	...
89	1	35	10	2	...	...	...	...	...	...
89½	4	15	10	...	...	18	14	...	...	...
89¾	1	14	11	...	...	10	5	...	...	...
90	2	13	7	...	...	2	...	...	...	...
90½	10	29	13	4	...	...	...	...	3	...
91	5	17	5	3	...	...	...	...	...	...
92¼	14	63	31	4	...	...	...	...	...	...
92½	...	29	...	...	...	13	7	...	10	...
93	4	12	5	2	...	...	...	...	...	...
93½	3	39	15	7	...	15	30	...	1	9
94½	11	18	6	...	...	6	...	...	...	...
95	5	21	4	...	...	...	...	...	10	...
96	3	19	11	...	...	...	...	...	...	...
98¼	2	18	9	6	...	35	20	...	2	...
98¾	2	36	13	2	...	9	4	...	...	...
99	...	50	15	...	...	25	...	...	...	...
99¾	14	25	15	...	...	...	...	...	...	...
100	...	50	...	...	...	4	80	...	20	...
100¼	9	25	10	...	...	...	8	...	1	...
103¼	6	22	9	...	...	...	...	...	...	...
103½	7	21	8	...	...	...	...	...	...	...
103¾	2	11	6	...	...	...	...	...	...	...
104¼	12	23	9	...	...	10	35	...	...	...
104½	1	12	...	...	...	...	...	...	...	...
107	3	17	13	...	...	...	...	...	...	...
107¼	3	21	8	...	...	...	...	...	...	...
107⅜	3	23	12	...	...	...	...	...	1	...
107½	2	7	4	...	...	...	...	...	...	...
107¾	3	9	3	...	...	27	7	...	38	...
108	2	170	60	...	...	21	5	...	...	...
108¼	8	30	27	2	...	52	...	...	...	...
108½	13	20	16	5	...	...	...	...	...	...
108¾	3	3	3	...	...	...	47	...	...	...
109	6	7	12	4	...	...	...	...	...	...
109¼	8	9	22	3	4	...	...	...	...	...
109½	11	19	21	...	...	...	...	...	...	...
109¾	1	24	18	...	...	...	...	...	2	...
110	6	30	8	...	...	101	49	4	...	...
111	4	58	21	2	...	74	69	...	24	...
111½	2	25	14	1	...	10	8	...	...	...
112	4	14	11	...	...	...	...	...	...	...
112½	3	11	15	...	...	27	75	...	...	...
113	1	7	34	...	...	21	7	...	...	...
113½	4	29	22	...	...	48	23	...	5	2
113¾	10	7	8	...	...	10	9	...	11	...
115	1	17	10	...	...	16	9	...	11	...
116	5	19	3	...	...	10	4	...	15	...
119	2	12	2	...	...	9	3	...	24	...
119¼	17	147	183	16	...	4	...	...	17	...
119½	1	24	2	3	...	...	...	...	...	...
119¾	2	15	8	3	...	3	...	...	...	5
120	1	16	4	9	...	2	...	...	2	...
120¼	8	23	14	1	...	...	...	...	9	8
120½	8	24	11	11	...	...	...	...	3	...
120⅝	2	58	18	17	...	...	...	...	5	22
120¾	3	50	81	1	...	34	38	1	18	5
121	5	135	42	46	...	...	...	...	...	17
121¼	3	19	9	6	...	2	...	...	7	2
121½	5	33	14	3	...	...	...	...	8	38
121¾	1	70	21	10	...	...	...	...	4	100
122	2	33	7	4	3	47	32	...	6	6
122¼	3	40	12	9	...	2	...	...	1	...
122½	4	27	23	10	...	...	...	...	7	...
122⅝	10	71	25	8	...	...	...	...	...	...
123	2	63	23	8	4	11	...	...	5	...
124	4	34	19	8	...	2	...	...	21	...
124¼	...	23	9	2	...	...	...	...	1	...
124½	...	27	6	9	...	...	...	...	13	...
124¾	1	25	12	8	...	...	...	...	2	...
125	...	27	9	7	...	...	...	...	...	...
125¼	...	41	27	9	...	...	...	3	6	...
125⅜	3	59	16	3	3	8	...	...	...	204
125½	2	40	16	1	...	17	4	...	...	...
125¾	1	39	16	5	...	...	...	...	...	...
126	1	23	7	9	...	16	5	...	5	...
126½	6	96	35	29	...	48	36	...	4	9
126¾	7	45	22	7	...	5	...	...	4	...
127	2	21	13	2	...	3	...	...	7	...
127½	4	10	7	3	...	71	11	...	2	...
127¾	15	115	57	9	...	39	10	...	1	40
127⅞	3	48	15	...	...	...	...	...	...	...
128	3	66	30	3	...	...	...	...	...	...
128¼	3	14	10	...	...	...	...	...	...	100
128½	...	34	21	3	...	76	56	...	...	13
128¾	2	86	39	4	...	27	23	...	...	6
128⅞	2	78	34	8	...	...	...	...	...	...
123¾	1	9	2	1	...	9	7	...	8	4
129¼	1	22	11	2	...	30	25	...	10	...
129½	2	30	15	...	...	...	...	...	7	...
130	3	17	10	...	...	...	98	...	...	...
130¼	1	18	11	1	...	...	...	...	...	...
130¾	1	14	5	2	...	...	...	...	...	72
130⅞	1	17	6	18	...	42	18	...	15	25
131	4	19	9	3	...	46	33	...	23	15
131¼	6	26	16	5	...	...	...	...	24	...
132	3	26	24	5	...	25	12	...	2	15
132½	1	10	3	5	...	...	...	...	20	...
133	2	19	5	4	...	...	...	...	16	...
133½	2	20	4	3	...	...	...	...	...	...
134	1	26	7	2	...	...	...	...	10	...
134¼	3	21	3	...	...	...	...	...	...	...
134½	7	32	5	6	...	...	...	...	5	...
134¾	3	20	7	3	...	2	...	...	6	...
135	1	11	9	5	...	3	...	...	6	...
136	1	26	3	4	...	...	...	...	...	12
136¾	6	26	23	14	...	1	...	...	...	...
137½	4	21	16	4	...	...	...	...	...	8
137¾	5	40	28	9	...	...	...	...	1	27
138	1	16	11	5	...	...	...	...	...	24
138½	1	17	9	2	...	...	...	...	...	...
139¾	2	11	4	2	...	...	...	...	...	5
	520	3,825	2,000	474	14	2,815	2,843	8	503	1,131

2. Oconee River, Georgia.—Summary of work by months, 1893-'94.

Month.	Total days worked.	Number of days removing obstructions.	Snags.			Stumps.	Overhanging trees.		
			First class.	Second class.	Third class.		Cut.		Pulled back.
							Over 8 inches.	Under 8 inches.	
July	30	26	43	310	181	57	13	....	....
August	30	26	44	343	136	78	119	63	....
September	30	26	18	305	114	73	1,412	1,753	....
October	30	26	53	552	262	28	87	56	14
November	30	26	34	354	138	113	178	53	....
December	30	26	64	412	268	50	133	82	....
January	30	26	12	402	183	21	80	62	....
February	30	27	68	256	298	15	186	310	....
March	30	25	48	266	114	21	471	290	....
April	30	26	58	368	158	15	35	46	....
May	30	26	73	250	145	3	101	116	....
June	7	5	5	7	3	....	....	3	....
Total	337	291	520	3,825	2,000	474	2,815	2,843	14

Month.	Trees girdled.	Logs on bank cut.	Explosives used.	Rock quarried and placed in jetties.	Brush placed in jetties.	Sand and gravel removed.	Piles driven.	Wattle work.	Brush mat.
			Lbs.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*		*Lin. ft.*	*Lin. ft.*
July	....	34	70	....	....	....	....	....	....
August	....	78	100	....	....	....	11	....	....
September	....	59	194	5	15	....	....	80	[illegible]
October	4	89	544	....	....	266½	....	....	....
November	....	35	14	....	....	....	....	....	....
December	....	19	82	....	....	....	....	....	....
January	....	32	6	....	....	....	....	....	....
February	....	43	20	....	....	....	....	....	....
March	4	98	6	....	....	....	....	....	....
April	....	12	95	....	....	....	....	....	....
May	....	4	....	....	....	....	....	....	....
June	....	....	....	....	....	....	....	....	....
Total	8	503	1,131	5	15	266½	11	80	[illegible]

3. Oconee River, Georgia—Detailed statement of work to date, 1878-1894.

	Snags.			Stumps.	Overhanging trees.			Trees girdled.	Logs on bank cut.
	First class.	Second class.	Third class.		Pulled back.	Cut.			
						Over 8 inches.	Under 8 inches.		
1878-1893 (Report of Chief of Engineers, U. S. Army, 1893)	1,325	4,043	1,602	330	2,264	12,439	20,007	670	[illegible]
1893-'94	520	3,825	2,000	474	14	2,815	2,843	8	[illegible]
Total	1,845	7,868	3,602	804	2,278	15,254	22,850	678	[illegible]

	Explosives used.	Driftwood cut.	Rock removed.	Rock quarried and placed in jetties.	Brush placed in jetties.	Sand and gravel removed by blasting.	Piles driven.	Wattle work.	Brush mat.
	Lbs.	*Cords.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*		*Lin. ft.*	*Lin. ft.*
1878-1893 (Report of Chief of Engineers, U. S. Army, 1893)	657½	366½	490	600	25	....		....	[illegible]
1893-'94	1,131	....	....	5	15	266½	11	[illegible]	[illegible]
Total	1,788½	366½	490	605	40	266½	11	80	[illegible]

COMMERCIAL STATISTICS.

Commercial statistics Oconee River, Georgia, 1893–'94.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
Timber	88, 000	$440, 000	Fertilizers	920	$18, 400
Rosin	14, 880	148, 800	Corn	645	51, 600
Turpentine	2, 225	111, 250	Cotton seed	585	11, 700
Cotton	1, 200	192, 000	Passengers	895	13, 425
Staves	2, 785	228, 800			
Merchandise	3, 141	470, 650	Total	115, 276	1, 680, 625

N 7.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

The Ocmulgee River is formed by the junction of the South and Yellow rivers, about 20 miles below Covington, and flows thence in a southeasterly direction about 250 miles, where it unites with Oconee to form the Altamaha. A detailed description of this river is found in my report of the preliminary examination and survey, printed as House Ex. Doc. No. 215, Fifty-first Congress, first session. For a special history of past work see p. 1258, Annual Report of the Chief of Engineers for 1890.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with depths of not more than 2 feet. The chief obstructions to navigation consist of rock shoals, sand bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The plan of improvement, as outlined in my report of February 5, 1890, provides for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water, from Macon to the river's mouth.

This is to be obtained by (1) removing rock shoals and sand bars, (2) closing incipient cut-offs and revetting caving banks, (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement is estimated at $210,000, provided funds are regularly and adequately supplied.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

Between 1817 and 1837 the State of Georgia expended about $60,000 in the improvement of the river, $10,000 of which were used above Macon. In August, 1887, operations were begun under the project approved by Congress in 1876, and the work has been carried on at intervals, as the funds were available. In all there have been removed from the river 13,010 snags and stumps, 29,197 overhanging trees, 359 cubic yards of rock, and 1,869 cubic yards of earth; 246 logs were cut up on the banks, and 926 trees were deadened; 12 jetties and 278 linear feet of crib bank protection were built at Tillman Bar, 2 snag dams at Ashley Landing, and 1 snag dam at Indian Timber Landing.

Up to July 1, 1893, the total expenditures for this work, including all outstanding liabilities, amounted to $43,782.35.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

The snag boat *Satilla* continued operations from the beginning of the fiscal year to February 1, 1894, when the available funds were exhausted. During this time there were removed from the channel 1,461 snags and stumps; 4,498 overhanging trees, and the wrecks of 3 steamboats; 919 trees were girdled, and 58 logs were cut on bank; 186 pounds of explosives were used.

The steam hoister, rigged as a pile-driver, continued work from the beginning of the fiscal year until October 31, during which time 285.5 cubic yards of solid rock and 287.5 cubic yards of loose bowlders were removed, 208 pounds of explosives having been used.

CONDITION OF WORK JUNE 30, 1894.

A fairly navigable channel has been opened from the mouth of the river to Macon, Ga.

The condition of the jetties at Tillman Bar is good, and a channel of 5 feet depth at summer low water is now maintained over the bar.

The rock shoals require especial attention at this time, and when the river is at its low-water stage a sufficient force should be put at work between Abbeville and Tillman Bar, in order to open the channel through in one month.

COMMERCE AND NAVIGATION.

The following is a list of steamers plying the Ocmulgee River during the fiscal year 1893-'94:

List of steamboats plying the Ocmulgee River, Georgia, 1893-'94.

Name.	Draft, light.	Tonnage, registered.	Terminals.
	Inches.		
Harry G. Day	16	299	Ocmulgee Depot, Abbeville and Red Bluff.
Lumber City	16	330	Do.
Swan (wrecked)	18	360	Brunswick and up-river points.
Mascotte	16	250	Macon and Brunswick.
J. C. Stewart	18	235	Abbeville, Macon, and Ocmulgee Depot.
Louisa	20	220	Abbeville and Florida Central and Peninsular Railroad bridge.
Total		1,694	

These boats carried during the last fiscal year about 20,500 tons of freight, valued at somewhat more than $1,000,000. The freights consist mainly of rosin, spirits of turpentine, fertilizers, corn, and merchandise. In addition to this it is estimated that t e were rafted over the river 94,000 tons of timber, valued at $470,000. The total commerce of the river during the fiscal year just closed was, therefore, 114,470 tons, valued at $1,528,300, an increase as compared with the year before of 4,177 tons in weight and $171,385 in value.

A full and carefully prepared statement of the conditions and circumstances that will affect this commerce, when the river is placed in a thoroughly navigable condition from its mouth to the city of Macon, is contained in Mr. J. L. Van Ornum's report on the survey of the Ocmulgee River, accompanying my report of February 5, 1890, and printed as part of Appendix O 12, Report of the Chief of Engineers for 1890, to which I respectfully refer. It is impossible to make an accurate estimate of the increased commerce that will follow such improvement. But remembering that new boats are to be added to the Lumber City, Hawkinsville, and Abbeville lines; that the citizens of Macon await the opening of the freighting season to fully establish a line of steamers to the coast; that more frequent trips can be made and larger cargoes carried, and that a new region between Hawkinsville and Macon will become tributary to the river, it is not an extravagant estimate to say that the commerce of the river may be increased 100 per cent of its present value.

Commercial statistics, Ocmulgee River, 1893-'94.

Articles.	Tons.	Value.	Articles.	Tons.	Value.
Timber	94,000	$470,000	Fertilizers	950	19,000
Rosin	8,300	83,000	Corn	300	24,000
Turpentine	2,600	130,000	Cotton seed	160	3,200
Cotton	260	45,500	Passengers	1,360	20,400
Staves	3,540	283,200			
Merchandise	3,000	450,000	Total	114,470	1,528,300

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1893, $5,768. Sapelo Light is the nearest light-house, and forts Oglethorpe and Pulaski are the nearest forts.

Since the existing project for improving Ocmulgee River was adopted the following appropriations have been made for this work:

By act of Congress of—

August 11, 1888 (unexpended balance)	$224.95
September 19, 1890	30,000.00
July 13, 1892	25,000.00
Total	55,244.95

The total expenditures under the existing project to June 30, 1894, including all outstanding liabilities, amounted to $54,169.28.

As outlined in my project of February 5, 1890, it is proposed to expend any funds now available or that may become available during the present fiscal year in the removal of obstructions and in the improvement of the shoals in the river between Macon and the river's mouth.

The sum of $50,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every high-water season. They should, however, become fewer in number each year. From $1,000 to $5,000 will be required for the annual maintenance of the completed work. The work of removing obstructions has been under the local charge of Mr. R. S. Burnett, assistant engineer, whose report is appended hereto.

Money statement.

July 1, 1893, balance unexpended	$11,958.63
June 30, 1894, amount expended during fiscal year	10,882.96
July 1, 1894, balance unexpended	1,075.67
Amount (estimated) required for completion of existing project	155,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

REPORT OF MR. R. S. BURNETT, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 5, 1894.

CAPTAIN: I respectfully submit the following report on the improvement of the Ocmulgee River, Georgia, for the fiscal year ending June 30, 1894:

SNAGGING OPERATIONS.

The snag boat *Satilla* continued operations between Hawkinsville and Macon until October 26, 1893, when she proceeded to clear the channel of obstructions from the mouth of the river to Hawkinsville.

The steamboat *Maggie Bell*, sunk in the channel at the wharf of the Savannah, Americus and Montgomery Railroad, Abbeville, Ga., was wrecked and removed in September.

The steamboat *Swan*, sunk in the channel at 114¾ miles, and the steamboat *Comet*, sunk in the channel at 116½ miles, were also wrecked and removed during the month of September.

U. S. steam hoister No. 1 was engaged on the river blasting a channel through the rock shoals and removing bowlders obstructing the channel. The hoister continued at work until October 31, when the crew were discharged, and the boat was tied up at Abbeville and placed in charge of a watchman.

The snag boat *Satilla* continued work until February 1, when operations were suspended owing to lack of funds, and with the steam hoister in tow proceeded to Savannah, arriving February 20.

The *Satilla* was delayed ten days at the Florida Central and Peninsular Railway bridge across the Altamaha River, due to the drawspan not being in working order.

A fairly navigable channel has been opened from the mouth of the river to Macon, Ga.

One new line of steamboats has been established between Abbeville and the Florida Central and Peninsular Railway bridge; also one new line between Hawkinsville and points above, toward Macon.

Tillman Bar.—The condition of the jetties at this bar is good in every respect. A channel averaging 5 feet in depth at summer low water is now maintained by these jetties. Deposit has been made by the river between the jetties; in several cases the river deposit has filled in to the height of the jetties.

Stadems Shoal.—At this rock shoal the steam hoister opened a channel 100 feet wide and 3½ feet in depth.

Rock Shoal at Hawkinsville.—A channel 25 feet in width was opened through the shoal by the snag boat *Satilla*.

The general condition of the river is good. The rock shoals require especial attention at this time, and when the river is at a low-water stage a sufficient force should be put on between Abbeville and Tillman Bar to open the channel through in one month.

There has been a falling off in the naval stores business and an increase in the hardwood staves and general merchandise.

Submitted with this report are the following papers:

(1) Statement of work done to date.
(2) Summary of work done, by months.
(3) Summary of work done, by localities.

Respectfully submitted.

R. S. BURNETT,
Assistant Engineer.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

1. Ocmulgee River, Georgia.—Detail statement of work done to date, 1877–1894.

	Jetties repaired and constructed.		Snags.			Stumps.	Overhanging trees.			
							Pulled back.	Cut.		Trees girdled.
	Quantity.	Number.	First class.	Second class.	Third class.			Over 8 inches.	Under 8 inches.	
1877-1894 (Report of Chief of Engineers, U.S. Army, 1893))..	2,266	23	1,713	7,793	3,162	342	3,155	12,506	13,536	926
1893-'94	....	....	198	634	448	181	1,770	754	1,974	919
Total	2,266	23	1,911	8,427	3,610	523	4,925	13,260	15,510	1,845

	Logs on bank cut.	Piles driven.	Piles cut off.	Wrecks.	Stone quarried and transported to the site of jetties.	Wattle work constructed.	Crib bank protection constructed.	Timber 12 by 12 inches laid in crib work.	Stone placed in mats and in crib work.	Brush cut and used constructing mats sunk around jetties.
1877-1894 (Report of Chief of Engineers, U. S. Army, 1893)..	246	124	121	......	*Cu. yds.* 972	*Lin. ft.* 926	*Lin. ft.* 318	*Lin. ft.* 7,861	*Cu. yds.* 1,112	*Cu. yds.* 1,163
1893-'94	58	....	....	3	....	....	....	....	....	....
Total	304	124	121	3	972	926	318	7,861	1,112	1,163

1. Ocmulgee River, Georgia.—Detail statement of work done to date, 1877-1894—Cont'd.

	Poles cut and used in wattle work.	Poles cut and used constructing mats.	Material excavated constructing bank protection work.	Explosives used.	Spikes used, ⅜ by 10 inches, constructing bank protection.	Solid rock removed from shoals.	Loose bowlders removed from shoals.	Holes drilled and blasted.	Drilled in rock.	Charges exploded.
			Cu. yds.	*Lbs.*		*Cu. yds.*	*Cu. yds.*		*Lin. ft.*	
1877-1894 (Report of Chief of Engineers, U. S. Army, 1893)	2,085	775	1,080	309½	2,500					
1893-'94	....	....	....	208	....	285.5	287.5	64	191½	[illegible]
Total	2,085	775	1,080	517½	2,500	285.5	287.5	64	191½	[illegible]

2. Ocmulgee River, Georgia.—Summary of work done by months, 1893-'94.

Months.	Snags.			Stumps.	Overhanging trees.			Trees girdled.	Logs in bank cut.
	First class.	Second class.	Third class.		Pulled back.	Cut.			
						Over 8 inches.	Under 8 inches.		
July	17	45	37	1	1	....	11	....	1
August	....	....	....	....	....	....	....	....	....
September	47	78	69	103	48	53	1,616	....	9
October	17	43	29	2	1,716	255	171	20	11
November	50	123	115	27	....	114	176	50	[illegible]
December	30	95	70	15	....	171	....	88	[illegible]
January	37	250	128	33	5	161	....	701	15
Total	198	634	448	181	1,770	754	1,974	919	[illegible]

Months.	Explosives used.	Wrecks removed.	Explosives used.	Solid rock removed from shoals.	Loose bowlders removed from shoals.	Holes drilled and blasted.	Drilled in rock.	Charges exploded.
	Lbs.		*Lbs.*	*Cu. yds.*	*Cu. yds.*		*Lin. ft.*	
July	18½	....	18½	118.5	22.8	13	19½	[illegible]
August	....	....	14	18	59.7	15	100	15
September	67½	3	61	149	....	36	72	[illegible]
October	66½	....	114½	....	205	....	....	[illegible]
November	33½	....	....	....	....	....	....	....
December	....	....	....	....	....	....	....	....
January	....	....	....	....	....	....	....	....
Total	186	3	208	285.5	287.5	64	191½	[illegible]

3. Ocmulgee River, Georgia.—Summary of work by localities, 1893-'94.

Distance above forks.	Snags.			Stumps.	Overhanging trees.			Trees girdled.	Logs on bank cut.	Explosives.	Wrecks.
	First class.	Second class.	Third class.		Pulled back.	Cut. Over 8 inches.	Cut. Under 8 inches.				
Miles.										*Lbs*	
0⅛	1	4	8	1		7			2		
3¾	3	19		1		2			1		
5¾	2	17	6	3		33		87	3		
8¾	1	8	5			11		15	1		
13¼	5	6	3	2		30	60	52	4		
13⅜	5	13	2	2		10					
14⅜	13		11								
14¾	1	15	5	2		7		1			
15	3	17	5			2					
15¾	3	13	5	1		4		25	2		
16	2	12				15					
16¾	1	20	3	3		15		12	1		
18¼	13	6	4			9		64			
19¼	3	6	3	1		7		70	2		
21¾	1	11	10	3		3		4			
23¼	2	15	2			7		72			
23¾	6	23	8	2		15		77	1		
25	2	12	5			11		94	3		
25¼	1	7	2	3		4		98		8½	
25⅜	1	3	2	1							
25⅝	2	13	6	1				6	1		
25¾	1	14	10	2		6		15	2		
26	3	13	9	1	5	1		50	1		
26¼	1	6	8					54			
26⅝	2	10	8	6							
31¼		14	6	6		21		17			
49¼	1	4	7			26			3		
58⅜	1	5	8	2							
59¼	3	16	20	6							
59¾	3	12	14			17					
61⅜	3	5	7			5					
63¼	3	3	3	1		1	13				
65½	1	8	9			21	48	4	1		
66¼	2	8	5	1		25	55	32	1		
85¾	2	2	2	2		13	32	24			
87¾	2	7	8	3		23		26	2		
90	5	7	5			4	8				
91	2	8	10								
91⅜			5								
91¾			3		272	9	260				
92					257	15	242				
92¼					220	23	197	3			
92½					254	21	233				
92¾					302	28	274	6	2		
93					217	29	188				
93¼					194	22	172				
93⅜	6	20	17	1		15	19	3	1		
93½	4	5	2	1							1
93¾	2	3	7			2					
94½	2	6	3			7	5				
96¼	3	5	1			8	14	8	6		
97	4	3	2			13	3				
98	2	5	2	2		8	9				
103½	3	2	5	1							
108½	2	5		4						10½	
109	2	3	1								
114½	8	11	7	3		6	8		5		
114¾	2	4	11								1
115½	1	5	9	4		28	31			1½	
116½	1	12	5	3		10	16		1	59	1
116¾	4	10	1	3		8	15				
117½	2	14	8	2		2	17				
118	6	15	10	2		1					
118¼	2	8	18			6	15				
126½						68					
133½		2				11			3		
133¾		1				2					
135½		6				5	3				
136	1	2	1			3					
138	4	7	10			2					
139	4	9	9		1	2			3		
140	6	17	13			2					
140½	1	8	4								
143¾	3	6	3	6		7	37		3	68	
147½				47	44	24					
147⅓	7	19	24	8		6					
147½	4	12	1		3	5					
147⅞	5	36	32	37	1	1			3	38½	
168	1	1		1							
Total.	198	634	448	181	1,770	754	1,974	919	52	186	3

N 8.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

About 2 miles above the city of Brunswick, Turtle River is divided by Buzzard Island into two branches, the smaller one, flowing to the eastward of the island and upon which the city of Brunswick is situated, being known as East River, the other retaining the name of Turtle River. These streams unite again about 1½ miles below the city to form Brunswick River. The lower part of East River forms what is known as the harbor of Brunswick. Operations for the improvement of this harbor have been carried on in accordance with a project of improvement prepared by Gen. Gillmore, the officer then in charge, and printed as Appendix M 12, Annual Report of the Chief of Engineers for 1886. This project is an enlargement and modification of a previous one submitted by the same officer and printed as Appendix J 7, Annual Report of the Chief of Engineers for 1880.

For a special report of past work see p. 1047, Annual Report of the Chief of Engineers for 1888, and the annual reports of the same officer since that date.

ORIGINAL CONDITION.

Turtle and Brunswick rivers have low-water depths of from 4 to 6 fathoms. Over the shoal in the East River, in front of the city, there was, when the existing project of improvement was adopted, a low-water depth of only 1½ fathoms. The mean rise and fall of tide is about 6.8 feet.

PLAN OF IMPROVEMENT.

The following comprise the main features of the plan of improvement:

(1) A training wall, projecting from the most easterly point of Buzzard Island and located approximately parallel to and 1,000 feet, or less, distant from the opposite shore of East River.

(2) A low dam across Turtle River, extending obliquely upstream from the upper end of Buzzard Island to the opposite shore of Blythe Island.

(3) Short spur jetties in the lower part of East River.

(4) Dredging in the vicinity of Turtle River Dam and on the shoal in the lower part of East River.

The training wall and spurs were to be constructed of palmetto cribs loaded with stone, or of successive courses of log and brush mattresses loaded with riprap stone. The works were intended to establish and maintain a 15-foot low-water channel across the shoal in East River. The cost of the original project was estimated at $73,187.50, and as modified at $190,000.

In 1836 an appropriation of $10,000 was made for the removal of the shoal in East River. Since the adoption of the existing project nine appropriations have been made by Congress for the work, aggregating $190,000.

The project of improvement needs revision.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

A training wall was constructed, springing from a point on the eastern side of Buzzard Island, and extending N. 77° 30′ E., 335 feet; thence S. 14° 30′, 650 feet; thence S. 12° E., 3,549 feet, to its present end.

The return work (with the exception of a shore extension 35 feet in length, built of log mattresses) and 780 feet to the main training wall were constructed of palmetto cribs; the rest of the training wall, 3,419 feet in length, of double-raft mattresses loaded with riprap stone. Forty-nine cribs were used, 14 of which are in the return work. Each crib is from 20 to 25 feet in length and from 9 to 13 feet in width. The cribs were filled with brush and dredged material, capped with stone, and rose from the bottom to the level of mean low water.

The double-raft mattresses are from 30 to 40 feet wide, from 3 to 4 feet thick, and are loaded with about 12 inches of stone. In raising to a higher level the work already done, ordinary log and brush mattresses from 15 to 30 feet in width and loaded with from 4 to 8 inches of stone were used.

The old palmetto crib work being too narrow to build upon, foundation courses of mattresses 30 feet wide were laid behind th cribs and close against them. Upon this foundation, courses of n ur sses 20 feet in width were laid until the work was raised to the level of the old cribs. The next course then overlapped the old crib work, and upon this new crest mattresses of from 15 to 20 feet in width were laid. Along the return face and at the angle point apron mattresses were laid on the channel side of the work to guard against scour. The return face was brought up to mean high water and the training wall to 4 feet above mean low water at the angle, gradually sloping down to the level of low water at a point 780 feet beyond.

In 1889 work was resumed, and up to July 1, 1893, the crest had been brought up with brush fascines and loaded with riprap stone to about 5 feet above mean low water for a distance of about 2,990 feet, measured from the return angle of the work. On June 22, 1893, work was again resumed and continued to the end of the fiscal year. There were used in this work 17,877.87 cubic yards of fascines and 3,138.77 cubic yards of riprap stone. Dredged cuts from 60 to 100 feet in width and from 14 to 15 feet deep at mean low water were made at various times across the shoal. The material removed consisted of a mixture of sand, loam, and clay, and aggregated 279,652.34 cubic yards.

Up to July 1, 1893, the total expenditures for the work, including outstanding liabilities, amounted to $180,918.92.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

Jetty work, under contract of March 20, 1893, with the Atlantic Contracting Company, was continued until the 9th of July, when it was stopped, the funds available for the work having been exhausted. There were put into the jetty during the year 3,332.46 cubic yards of brush fascines and 780.87 cubic yards of riprap stone. The current observations required for a revision of the project were completed during the year.

CONDITION OF WORK JUNE 30, 1894.

The training wall is in good condition. Some slight settlement has taken place near the middle of the wall. Although no dredging has been done during the fiscal year just closed, the 15-foot curve has remained practically continuous over the shoal in East River.

COMMERCE AND NAVIGATION.

Previous to the year 1871 the city of Brunswick was of slight commercial importance, the value of the exports for that year being less than $500,000. In 1875 the value of the total exports had increased to $639,000. From that year up to the present, and especially since 1880, the importance of the city of Brunswick has increased with remarkable rapidity.

In 1880 the population of Brunswick was 2,981; it is now estimated at more than 12,000. Taxable property increased in value from $1,300,000 in 1880 to $6,000,000 in 1890. The naval-stores business did not begin here until 1875, but in 1892 there was a yearly business of more than $1,000,000. During the same period the lumber business shows an enormous increase. The supply of yellow pine timber is within easy reach of this port and is practically inexhaustible. White oak, ash, cypress, hard woods, American mahogany, and live oak are accessible within short distances, and all other classes of hard woods are obtainable in unlimited quantities from Alabama, Tennessee, and North Georgia. In 1880 there were shipped from this port 37,000,000 feet of lumber; in 1892 the shipments of lumber amounted to 138,035,000 feet, valued at $1,657,220. Lumber was at one time the chief export of Brunswick, but cotton now holds that place. The exports of this staple during the season of 1884–'85 amounted to but 4,000 bales. Since then the exports of this article have increased wonderfully, and the shipments in 1892 amounted to about 170,000 bales, valued at $6,472,000.

The considerable falling off of the shipments during 1893 (which are rendered below) was caused by the almost complete suspension of trade during the summer and fall of that year, on account of a yellow fever epidemic. Like the circumstances which caused it, this setback may confidently be expected to have been of a temporary nature only.

The following lines of steamers have been established:

Mallory Line, Brunswick to New York, 1 steamship per week.
Brunswick to Savannah, 2 steamers per week.
Brunswick to Fernandina, 1 steamer per day.
Brunswick to Darien, 1 steamer per day.
Brunswick to river points, 7 steamers per week.

The passenger traffic to and from New York over the line now in operation would be greatly stimulated were the outer bar improved so that the steamship company could positively announce the departure of its steamers from Brunswick at the same hour every sailing day, irrespective of tides. The inward-bound steamers are often compelled to wait outside the bar for high water, and this circumstance tends to retard the development of the inward passenger traffic.

Besides the lines of steamers previously mentioned a large fleet of foreign and coastwise steam and sailing vessels is engaged in the Brunswick trade, which consists principally of shipments of cotton, naval stores, and lumber.

Commerce, foreign and coastwise.

Articles.	1892.			1893.		
	Amount.	Value.	Tons.	Amount.	Value.	Tons.
Cotton.......bales..	170,643	$6,472,375	42,660	26,285	$1,041,774	[illegible]
Rosin.......barrels..	206,179	556,683	25,772	139,167	309,131	[illegible]
Turpentine.......do....	48,944	709,668	11,382	39,418	485,146	[illegible]
Lumber.......M feet..	138,035	1,657,220	345,088	49,340	578,246	[illegible]
Cross-ties.......number..	961,800	480,900	50,621	47,719	16,914	[illegible]
Miscellaneous.......tons..	61,902	610,920	61,092	....	366,762	[illegible]
Total..........	....	10,487,786	536,615	....	2,797,973	[illegible]
Estimated shipments, coastwise....	....	....	....	....	4,500,000	[illegible]
Estimated receipts by water, foreign and coastwise..........	....	3,164,917	140,000	....	1,680,512	[illegible]
Total commerce..........	....	13,652,703	676,615	....	8,978,485	[illegible]

Persons interested in the trade of Brunswick estimate that owing to past work of improvement in the harbor freight rates have been reduced from 18 to 20 per cent, and that if the improvements were completed according to the existing project the total volume of trade would be increased 200 per cent.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1893, $5,768. St. Simons Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

Since the work of improvement has begun, the following appropriations have been made:

By act of Congress of—		By act of Congress of—	
March 3, 1879	$20,000	August 11, 1888	$35,000
June 14, 1880	10,000	September 19, 1890	35,000
March 3, 1881	5,000	July 13, 1892	27,500
August 2, 1882	25,000		
July 5, 1884	10,000	Total	190,000
August 5, 1886	22,500		

The current measurements necessary for the proper revision of the project of improvement were completed during the last year. The sum of $15,000 can be economically and advantageously expended during the coming fiscal year in maintaining the present channel depths by dredging.

The total expenditures to June 30, 1894, including all outstanding liabilities, amounted to $190,000.

Money statement.

July 1, 1893, balance unexpended	$17,251.13
June 30, 1894, amount expended during fiscal year	17,251.13
Amount (estimated) required for maintenance of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Brunswick, Ga., from January 1, 1878, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	116	32,584	850	36	10,218	270	41	19,008	493	193	61,810	1,613
1879	148	44,397	1,000	33	8,235	232	40	17,589	468	221	70,221	1,790
1880	271	77,656	1,891	36	11,219	317	39	14,996	432	346	103,871	2,641
1881	279	100,451	2,239	13	4,174	98	63	30,279	751	355	134,904	3,088
1882	335	123,149	2,659	7	2,095	57	63	26,958	694	405	152,202	3,416
1883	299	110,302	2,368	11	4,814	107	87	40,765	979	397	155,881	3,454
1884	239	88,063	1,893	10	4,434	88	126	62,818	1,435	375	155,315	3,416
1885	242	93,280	1,928	10	3,216	76	94	43,284	1,037	346	139,780	3,052
1886	229	88,244	1,751	7	3,202	48	98	47,798	1,164	334	139,304	2,835
1887	194	86,731	1,625	8	2,251	116	102	54,537	1,232	304	144,519	2,973
1888	821	290,590	3,619	9	2,991	76	147	80,330	1,729	977	373,911	10,424
1889	220	92,831	1,764	20	10,035	176	191	113,757	2,403	431	216,623	4,343
1890	316	196,701	3,844	23	7,513	186	126	71,158	1,559	465	275,372	5,589
1891	374	235,565	5,462	29	8,025	164	107	70,228	1,523	501	313,818	6,149
1892	439	279,998	4,450	42	20,548	354	134	85,332	1,812	615	385,878	6,616
1893	431	255,367	4,392	48	23,384	371	123	93,634	1,710	602	372,385	6,473

Arrivals and clearances of vessels and commerce at Brunswick, Ga., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	124	32,767	874	28	9,231	236	49	21,218	550	201	63,216	1,660
1879	157	42,345	1,116	21	7,172	172	47	21,730	555	225	71,247	1,843
1880	270	78,913	2,010	14	5,010	115	48	19,970	550	332	103,900	2,675
1881	252	82,155	1,732	17	7,218	156	87	42,659	1,014	356	132,932	1,902
1882	278	96,170	2,086	19	7,761	170	101	48,699	1,139	398	152,630	3,395
1883	257	91,036	1,962	28	11,268	240	124	55,717	1,369	411	158,021	3,571
1884	176	62,927	1,322	38	16,209	335	148	70,612	1,633	362	149,478	3,290
1885	196	71,345	1,481	21	8,696	190	135	62,437	1,456	352	142,478	3,127
1886	184	67,020	1,413	17	7,528	159	117	56,280	1,305	318	130,828	2,877
1887	130	51,305	958	5	5,858	143	121	72,894	1,526	276	130,057	2,627
1888	785	266,152	8,240	13	4,715	116	173	102,300	2,236	971	373,227	10,592
1889	169	65,809	1,273	11	4,266	103	221	130,919	2,830	401	200,994	4,206
1890	247	122,820	2,024	18	8,745	165	172	107,197	2,261	437	238,762	4,450
1891	313	186,171	3,432	26	16,045	234	141	94,827	1,980	480	297,043	5,646
1892	390	247,329	4,228	19	6,882	174	163	109,728	2,334	572	363,939	6,736
1893	420	236,856	4,165	13	6,857	121	159	119,282	2,266	590	362,995	6,552

COMMERCE.

Year.	Value of exports.	Value of imports.	Total collection.
1878	$1,372,842	$400	$4,500.97
1879	1,394,401	3,197	5,644.23
1880	1,702,570	8,098	17,723.57
1881	2,230,000	4,377	29,305.39
1882	1,700,000	2,734	20,058.96
1883	3,437,000	3,093	24,911.61
1884	3,500,000	958	19,788.25
1885	3,063,960	4,008	3,909.17
1886	2,828,656	2,397	5,834.43
1887	4,121,660	*2,815,769	37,520.00
1888	7,552,025	*3,140,231	7,438.04
1889	7,894,281	6,557	8,833.46
1890	7,355,841	7,326	5,748.08
1891	*9,742,553	*3,014,207	5,982.07
1892	5,372,775	22,988	6,406.15
1893	7,297,973	1,680,512	5,768.06

* Coastwise and foreign.

Comparative statement of receipts and shipments of naval stores.

Year.	Receipts (barrels).						Shipments (barrels).							
	Stock on hand.		Receipts for year.		Total.		Coastwise and interior towns.		Foreign.		Stock on hand.		Total.	
	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.
1880....	3,000	600	36,495	8,661	39,495	9,261	29,339	8,371	7,201	650	2,935	240	39,475	9,261
1881....	2,935	240	67,562	13,490	70,297	13,730	37,029	8,621	18,077	3,009	15,191	2,100	70,297	13,730
1882....	15,191	2,100	104,357	23,459	119,548	25,559	46,785	11,533	52,072	11,826	19,791	2,200	119,548	25,593
1883....	19,791	2,200	80,078	16,105	99,769	18,305	9,846	5,183	74,687	12,229	15,236	1,893	99,769	18,305
1884....	15,236	893	105,622	23,449	120,858	24,342	22,859	2,565	98,983	20,167	8,016	2,610	120,858	24,342
1885....	8,016	1,610	92,958	30,900	100,974	22,510	20,197	3,556	68,814	26,169	11,963	2,785	100,974	22,510
1886....	11,963	2,786	139,366	34,625	151,329	37,410	30,898	15,620	75,094	10,629	45,337	1,161	151,129	37,410
1887....	45,337	1,161	125,546	32,338	170,883	33,459	22,356	7,959	111,731	23,986	36,813	1,403	170,890	33,439
1888....	27,098	2,420	140,820	37,643	167,918	40,063	29,746	8,339	120,159	27,901	18,013	3,823	167,918	40,063
1889....	......	......	186,000	45,000	....	......	17,753	6,889	152,394	29,560	31,869	2,259	202,010	38,708
1890....	31,869	2,259	212,374	42,813	244,243	45,072	37,553	11,772	145,406	32,212	29,421	1,088	212,374	45,072
1891....	29,421	1,088	161,402	42,697	190,827	43,875	25,391	5,640	127,755	36,800	30,294	651	183,440	43,091
1892....	30,294	651	220,250	52,496	250,544	53,147	42,575	9,763	163,604	39,181	20,847	4,005	227,020	53,947
1893....	20,847	4,005	172,412	43,100	193,259	47,105	16,939	8,910	122,228	29,508	54,092	8,687	193,259	47,105

Thomas W. Lamb,
Collector of Customs.

Capt. O. M. **Carter,**
Corps of Engineers.

N 9.

EXAMINATION OF BRUNSWICK OUTER BAR, GEORGIA, TO DETERMINE RESULT OF WORK DONE BY MR. C. P. GOODYEAR, UNDER ACT OF CONGRESS OF MARCH 1. 1893.

[Public—No. 109.]

AN ACT to amend an act approved July twenty-seventh, eighteen hundred and ninety-two, entitled "An act to provide for the improvement of the outer bar of Brunswick, Georgia."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be authorized to pay to C. P. Goodyear, his heirs or assigns, upon the procurement by said C. P. Goodyear, his heirs or assigns, of a practicable channel over the outer bar of Brunswick, Georgia, at least one hundred feet in width, and of a minimum depth of twenty-two feet at ordinary mean high tide, on or before November first, eighteen hundred and ninety-three, the sum of ten thousand dollars; upon the procurement as aforesaid, on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar of a minimum depth at ordinary mean high tide of twenty-three feet, ten thousand dollars more, to be paid in manner aforesaid; upon the procurement as aforesaid, on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar at a minimum depth at ordinary mean high tide of twenty-four feet, ten thousand dollars more, to be paid in manner aforesaid; upon the procurement as afosesaid on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar of a minimum depth at ordinary mean high tide of twenty-five feet, ten thousand dollars more, to be paid in manner aforesaid; upon procurement on or before November first, eighteen hundred and ninety-three, of a minimum depth in said channel over said outer bar of twenty-six feet at ordinary mean high tide, and of a width not less than one hundred and twenty-five feet, ten thousand dollars more, to be paid in manner aforesaid; and should the depth of twenty-five feet, at ordinary mean high tide in said channel over said outer bar, be procured on or before the time aforesaid, and maintained for two years for the width named thereafter, twenty-five thousand dollars in addition, to be paid in manner aforesaid; and should the depth of twenty-six feet, at ordinary mean high tide for the width named, be procured on or before the date named, and maintained for two years thereafter, twenty-five thousand dollars in addition, to be paid in manner aforesaid. The said G. P. Goodyear, his heirs and assigns, shall perform said work on said outer bar by the explosion of dynamite on the bottom of said channel, or sunk beneath the bottom of said channel, in his or their discretion, and not otherwise; and the channel to be deepened as aforesaid shall be north of the present bouyed-out channel, so that said work shall not interfere with the commerce of the port of Brunswick during the progress of such work. The Secretary of War shall detail an officer of engineers to examine and report upon said work from time to time, at such times as the said C. P. Goodyear, his heirs and assigns, announce that they have complied with the conditions as to any of the depths and widths named, or as to the maintenance of depths of twenty-five and twenty-six feet, and payments to be made as aforesaid upon the certificate of such engineer that such depth and width, or such maintenance, has been accomplished in accordance with the provisions of this act. And said engineer officer shall specially report as to the means used to acquire and maintain said depths and widths. And the money necessary to carry out the provisions of this act is hereby reappropriated out of any money in the Treasury not otherwise appropriated.

Approved, March 1, 1893.

LETTER OF MR. C. P. GOODYEAR.

BRUNSWICK, GA., *November 1, 1893.*

Under the provisions of an act approved July 27, 1892, and amended in February, 1893, authorizing me to deepen the outer bar of Brunswick, known as St. Simons Bar, to any or all of the various depths named in the act, to and including November 1, 1893, I have to report that although compelled to suspend work in early August by the yellow-fever epidemic existing here, losing nearly three of eight months given by the amended act, I have procured a depth of more than 22 feet, I believe of 23 feet. As I have called for previous surveys which did not allow me the depths named in the act, I deem it proper to say that I now claim the depths named upon the actual crossing of the bar by vessel of 22-foot draft with more than a foot of water to spare, as tested by the Government tide gauges in the harbor upon a 7.6-foot rise of tide, this vessel, the *North Erin*, a steamship having sailed in July last. The absence of business during the epidemic, and my attention to the interests of the sick suffering have prevented personal visits to the bar, but the pilots report that there has been no shoaling since July, when the *North Erin* proceeded to sea.

I, therefore, feel justified in claiming, and do claim, that I have at least one of the depths named in the act, and while I recognize that while the prevalence of yellow fever upon Jekyl and St. Simons islands providentially interferes with an immediate survey, to save my rights under the act I respectfully ask for it.

Very respectfully, yours,

C. P. GOODYEAR.

Hon. DANIEL S. LAMONT,
Secretary of War.

[First indorsement.]

Referred by brief from Secretary of War to Chief of Engineers.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 4, 1893.

Respectfully referred to Capt. O. M. Carter, Corps of Engineers, for report, attention being invited to the act of Congress approved March 1, 1893, amending the act of July 27, 1892, relating to Brunswick Harbor, Georgia.

By command of Brig. Gen. Casey:

H. M. ADAMS,
Major, Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
Savannah, Ga., November 6, 1893.

Respectfully returned to the Chief of Engineers, U. S. Army, Washington, D. C., with the statement that I have no knowledge of the crossing of St. Simons Bar by "a vessel of 22-foot draft with more than a foot of water to spare."

Whether or not Mr. Goodyear has procured a channel across the outer bar at Brunswick, Ga., with the depths and widths named in the act of Congress approved March 1, 1893 (Public, No. 109), can be determined only by a survey of that bar, which will cost about $1,000. Such a survey can be made at once.

O. M. CARTER,
Captain, Corps of Engineers.

[Telegram.]

WASHINGTON, D. C., *November 8, 1893.*

Seven hundred and forty-eight dollars, in addition to the amount you have on hand, is allotted from the appropriation for examinations, surveys, and contingencies to enable you to make a survey of Brunswick Outer Bar. This survey should be made at once.

CASEY,
Chief of Engineers.

Captain CARTER.

REPORT OF CAPT. O. M. CARTER, CORPS OF ENGINEERS, ON 22-FOOT DEPTH.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., December 14, 1893.

GENERAL: I have the honor to submit herewith my report on an examination of the outer bar at Brunswick, Ga., made in compliance with instructions contained in a telegram from the Chief of Engineers, U. S. Army, dated November 8, 1893, and with a view to determining the results, if any, of the work done by Mr. C. P. Goodyear prior to November 2, 1893, as contemplated by act of Congress dated March 1, 1893.

The survey party was organized on the 8th of November and left for St. Simons on the 9th. Work was begun on the arrival of the party at that point and was continued as the weather permitted until the examination was completed. The bar was covered with lines of soundings from 10 to 50 feet apart. The lead line was read to the nearest tenth of a foot, and was tested at the beginning and ending of each day's work by a comparison with a standard steel tape. The greatest variation in the length of the lead line during the survey was one-tenth of a foot. The tide gauge established at the ocean pier on St. Simons Island was read every ten minutes while the work was in progress, and every sounding was corrected for the stage of tide and for the error of graduation of the lead line to reduce it to the true depth at mean low water.

The soundings were located by two transits on shore stations so situated as to give good intersection over the area to be covered. Work was done only in good weather, when the sea was smooth enough to insure a correct determination of the depth of water. There were taken in all 4,620 soundings, 1,540 of which were instrumentally located. The work has been plotted on a scale of 50 feet to the inch, and from the original map a tracing has been prepared showing characteristic soundings and curves of equal depth for every 12 inches from 12 to 18 feet. Soundings are expressed in feet and tenths and refer to the plane of mean low water as determined by the U. S. Coast and Geodetic Survey. This plane is one-tenth of a foot lower than the plane established by the U. S. Engineer Survey of 1890-1891. The mean rise and fall of the tide, as determined by the latter survey, is 6.64 feet; by the former survey it is 6.8 feet. To reduce the soundings of this examination to depths at mean high water (U. S. Coast and Geodetic Survey determination) 6.8 should be added. To reduce the soundings to mean high water (U. S. Engineer Department determination) 6.74 should be added. As the two determinations give results at mean high water differing by only 0.06 of a foot, it is practically immaterial which of the two reductions is used. The buoys marking the existing channel across the bar were also located instrumentally. Compared with their positions in January, 1893—

Buoy No. 2 is 450 feet south of January location;

Buoy No. 4 is 250 feet southwest of January location;

Buoy No. 4½ is 450 feet west of January location.

Two small spar buoys, one red and one black, supposed to have been placed in position by Mr. Goodyear, are also shown on the chart.

The general configuration of the bar, as shown by the survey, may be summed up as follows: The bar separating the deep-water inside from the deep water outside consists of two distinct shoals, a northerly and a southerly one, which are separated from each other by a depression, carrying for a width of 100 feet a mean low-water depth of more than 14 feet. This depression starts from the inside deep-water pocket, which cuts into the southwestern edge of the bar near buoy 4½, and stretches thence in an easterly direction across the bar to the deep water outside. The course of the greater depression is marked, as previously stated, by three red buoys, numbered 4½, 4, and 2.

While the general features of the bar are much the same as in November, 1892, and January, 1893, a shifting to the southward of both shoals and of the depression separating them has taken place since then. The channel in November, 1892, and in January, 1893, reached deep water on the outer slope of the bar about 1,200 feet to the north of the channel of 1891, while the present channel reaches the outer slope of the bar only about 800 feet to the north of the channel of 1891, as is shown on the accompanying blue print.

The area of the depression crossing the bar is somewhat less than in January, but the bottom in more regular and there is a slight increase in depth, the present best 100-foot channel having nowhere a less depth than 14.1 feet at mean low or 20.9 feet at mean high water, and this only near the edge, the thread of the channel carrying minimum depths of 14.3 to 14.4 feet at mean low or 21.1 to 21.2 feet at mean high water.

Those figures when reduced to the plane of mean low and mean high water, as established by this office, are as follows:

(1) Least depth at any place in the best 100-foot channel, 14.2 feet at mean low or 20.84 feet at mean high water.

(2) Least depth on axis on the best 100-foot channel, 14.4 feet at mean low or 21.04 feet at mean high water.

The following summary of the results rendered by former surveys will serve to illustrate the changes in depths which have taken place in the bar channel since 1891.

A survey made in September, 1891, shows a minimum depth of 13.2 feet at mean low or 19.84 feet at mean high water in the best 100-foot channel across the bar.

From a survey made in November, 1892, it was found that the best 100-foot channel across the bar contained minimum depths of 13.5 feet at mean low or 20.14 feet at mean high water, while the thread of the channel crossed the bar with a depth of 14 feet at mean low or 20.64 feet at mean high water.

From a survey made in January, 1893, it was found that the least depth in the best 100-foot channel across the bar was 14 feet at mean low or 20.64 feet at mean high water.

From the present survey it has been found that the least depth in the best 100-foot channel across the bar is 14.2 feet at mean low or 20.84 feet at mean high water.

The gain in mean high-water depths across the bar from 1891 to 1893 is apparent from the following figures:

	Feet.
September, 1891	19.84
November, 1892	20.14
January, 1893	20.64
November, 1893	20.84

The width of the bar has not greatly changed, the distance between the 15-foot curves inside and outside being about 800 feet, and the distance between the 16-foot curves being about 1,300 feet, measured along the thread of the channel.

In view of all the facts herein presented, I am unable to certify that the provisions of the act of Congress, approved March 1, 1893, in so far as they relate to the depth of channel required on or before the last day of November, 1893, have been fulfilled.

With regard to "the means used to acquire and maintain said depths and widths," I have the honor to state that I was not detailed to examine the outer bar of Brunswick, Ga., as provided in the terms of the act of March 1, 1893, until the 8th day of November, 1893, since which time no work at that point has been done by Mr. Goodyear. For the reasons given I was not present when work was in progress, but I have been informed by reliable citizens of Brunswick, Ga., that all work performed by Mr. Goodyear since March 1, 1893, has been by the explosion of dynamite on the bottom of the bar channel.

A chart showing the results of the examination and a blue print showing the locations of the various channels from 1891 to 1893 are transmitted herewith.

Very respectfully, your obedient servant,

O. M. CARTER,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

N 10.

IMPROVEMENT OF JEKYL CREEK, GEORGIA.

Jekyl Creek forms a part of the inside passage between Savannah River, Georgia, and St. Johns River, Florida. It connects St. Simons Sound and Brunswick River at the north with Jekyl and St. Andrew sounds at the south. The creek is about 5 miles in length, is separated from the Atlantic Ocean by Jekyl Island, and debouches into Brunswick River about 6 miles from the town of Brunswick, Ga.

Operations for the improvement of this creek have been carried on in accordance with a project of improvement prepared by Gen. Gillmore, the officer then in charge, and printed as Appendix N 10, Annual Report of the Chief of Engineers for 1888.

ORIGINAL CONDITION.

With the exception of two points, the creek has ample widths and depths to accommodate the largest class of vessels that take the inside route. About a mile from its northern end a shoal is found between the points where Lathram and Mud River enter the creek, and from the mouth of the creek to the deep waters of Brunswick River, in the bight formed by the southern shore of the latter, there is an extensive mud flat. The least mean low-water depth across at the mouth of the creek was 3.7 feet. Across the shoal between Lathram and Mud rivers it was 3 feet. The mean rise and fall of the tide is 7.1 feet.

PLAN OF IMPROVEMENT.

The following comprise the main features of the plan of improvement:

(1) A training wall at the mouth of the creek, designed to guide the ebb currents across the mud flats to the deep waters of Brunswick River.

(2) Closing Mud River by means of a dam at some suitable point to prevent the escape of water through that branch at ebb tide.

(3) Dredging through the mud flats at the mouth of Jekyl Creek, and in the creek proper, near the mouth of the river.

The training wall and closing dam were to be constructed of log and brush mattresses, or brush fascines, and riprap stone below the level of low water; above that point stone alone was to be used. It was proposed to give the dredged channel a bottom width of 50 feet. The works were intended to establish and maintain a 7-foot low-water channel through the shoals.

The cost of the project was estimated at $38,590.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

The construction of the training wall at the mouth of the creek was begun on May 13, 1891, and was continued until June 8, 1891. Work was resumed on May 24, 1893, and continued to the end of the fiscal year, at which time the foundation course had attained a length of 2,008.8 feet, the second course 1,942.2 feet, the third course 1,719.7 feet, the fourth course 140 feet, the fifth course 130 feet, and the sixth course 90 feet. There were used in this work 19,453.19 square yards of brush mattresses, 28.17 cubic yards of brush fascines and 1,588.69 cubic yards of riprap stone.

There were removed by dredging 7,940.51 cubic yards of material inside of the creek and 25,546.33 cubic yards from the shoal outside the mouth, making a cut 7 feet deep at mean low water through it. Altogether there were, therefore, removed by dredging at various times 33,486.84 cubic yards of material.

Up to July 1, 1893, the total expenditures for the ork, including outstanding liabilities, amounted to $19,811.08. T re were also expended in performing the work described at that point, from the appropriation for "Improving inside water route between Savannah, Ga., and Fernandina, Fla.," including outstanding liabilities, the sum of $14,937.69.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

The annual examination was made in June, 1894.

CONDITION OF WORK JUNE 30, 1894.

The training wall is in good condition and is well covered with a thick growth of oyster shells. No dredging has been done during the year. A 6-foot channel follows the direction of the training wall to somewhat beyond its outer end; thence over the shoal the least depth is 5 feet, no material change having taken place during the year.

COMMERCE AND NAVIGATION.

The commercial value of the annual traffic through Jekyl Creek is estimated at about $1,000,000, and the amount of freight carried at about 30,000 tons. It is impossible to secure accurate figures, because most of the freight is billed by the package and no records of the weights and values are kept. The above estimate is, however, believed to be a close approximation to the truth. The freights through the channel outward from the cities of Savannah, Brunswick, and Fernandina consist mainly of general merchandise and mill supplies. The inward freights are cotton, naval stores, rice, fish, etc.

Tabular statement of commerce on Jekyl Creek.

Route.	Between—	Steamers.	Trips.	Freight.	Value.
				Tons.	
Savannah	Savannah and Brunswick	1	Weekly		$7,000
Sea Island	Savannah and Fernandina	*1	Biweekly	26,500	900,000
Cumberland	Brunswick and Fernandina	1	Daily	600	17,000
Satilla River	Brunswick and Satilla River	1	Triweekly	1,400	45,000
Jekyl Island	Brunswick and Jekyl Island	1	Daily	1,700	50,000
Total		5		30,200	1,019,000

*Towing 1 barge.

Vessels passing through adjacent ports are often towed through Jekyl Creek, thus avoiding rough water at sea and the necessity of taking in ballast.

The steamers on the Cumberland route and Jekyl Island route are passenger boats and carry but little freight. In addition to the boats above mentioned, many small craft, carrying rice, farm and garden produce, fish, and oysters, pass through this channel.

Owing to the shoal water in Jekyl Creek, the steamers passing through on their regular trips are often delayed several hours while waiting for a suitable stage of tide, and some are reported to have sustained injuries by running aground. The Cumberland route is a part of a through passenger line to Florida via the East Tennessee, Virginia and Georgia Railway, and the delays mentioned interrupt the schedule to the detriment of the passenger service. The completion of the works of improvement will undoubtedly be followed by a large increase in the amount of commerce passing through Jekyl Creek.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1893, $5,768. St. Simons Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

The following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888	$5,000
September 19, 1890	7,500
July 13, 1892	7,500
Total	20,000

In addition to this the sum of $15,000, appropriated for "improving inside water route between Savannah, Ga., and Fernandina, Fla.," was expended during the fiscal year ending June 30, 1893, at Jekyl Creek.

The irregular and inadequate appropriations heretofore made for this improvement have so increased its cost that, as recommended in my report of November 25, 1891, the original estimate of cost must be increased by more than $16,000.

It is estimated that the sum of $18,590 is necessary to complete this improvement. This amount can be economically and advantageously expended during the coming fiscal year. Unless the total amount is made available the cost of the work will be still further increased.

The total expenditures to June 30, 1894, including all outstanding liabilities, were $20,000.

Money statement.

July 1, 1893, balance unexpended	$3,822.[illegible]
June 30, 1894, amount expended during fiscal year	3,822.[illegible]
Amount (estimated) required for completion of existing project	18,590.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	18,590.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

N 11.

IMPROVEMENT OF CUMBERLAND SOUND, GEORGIA.

The entrance to Cumberland Sound is situated between Cumberland Island, Georgia, and Amelia Island, Florida.

Operations for improving the channel across the bar at this entrance have hitherto been carried on in accordance with a project of improvement submitted to the Chief of Engineers by Gen. Gillmore, the officer then in charge, dated June 30, 1879. A discussion of the general question of the application of jetties to this entrance is published as Appendix H 6, Annual Report of the Chief of Engineers for 1878.

For a detailed history of past work see p. 1054, Annual Report of the Chief of Engineers for 1888.

ORIGINAL CONDITION.

The available depth of the entrance in its unimproved condition varied from 11 to 12.5 feet at mean low water. The mean rise and fall of tide is 5.9 feet.

PLAN OF IMPROVEMENT.

The plan of improvement, as originally submitted by Gen. Gillmore in 1879 and revised by The Board of Engineers in March, 1891, provides for the construction of two low jetties, composed of riprap stone, with a mattress hearting whenever admissible, resting upon a foundation mattress of brush or of logs and brush, starting, respectively, from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties are intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and, as modified, at $1,606,500 for the completion of the low jetties, and at $2,079,500 if high jetties are found necessary.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

Nothing was ever expended in improving the entrance to Cumberland Sound previous to the adoption of the existing project. Since then appropriations have been made by Congress for the work, aggregating $762,500.

North jetty.—The shore end of this jetty is located on Cumberland Island, about 7,700 feet N., 26° 30′ W., from the eastern bastion of Fort Clinch. From this point it extends S. 61° 30′ E. 2,200 feet to the outer end of the first range; thence S. 80° E. 10,529.7 feet to the outer end of the second range; thence N. 82° E. to its seaward end (third range). Work on this jetty was commenced in June, 1881, and suspended in March, 1883. Operations were resumed on June 23, 1891, and were suspended on November 14, 1891. They were again resumed on October 31, 1892, and suspended on May 19, 1893, the funds available for the work having been exhausted. At this time the foundation course had been extended from the shore end of the jetty to a point 17,416.5 feet from it, as measured on the axis of the jetty, excepting for a space of 1,031.4 feet between Station 8762.7 and Station 9794.1, where a gap was left across a shoal that rises above mean low-water level. The inner end of the outer or seaward (third) range was reached at Station 12829.7.

In addition to the foundation course a second course had been built extending from the outer end of the first range 1,439 feet shoreward and from Station 10520.1 to Station 17416.5, or the present outer end of the third range. One mattress 80 feet wide and loaded with riprap stone was laid in the third course between Station 12514.9 and Station 12609.8, a distance of 94.9 feet.

Foundation courses of two spurs each 54 feet in length and 42 feet in width had also been laid on the harbor side of the jetty at distances of 1,627 and 1,800 feet from the shore end.

The mattresses of the foundation course vary in width from 25 to 52 feet as far out as about Station 7275; thence outward they are 100 feet in width. The mattresses of the second course vary in width from 20 to 25 feet on the first range; they are 80 feet wide on the second range, and they are 80 feet and 90 feet wide on the third range. The linear length of work done is 16,385.1 feet on the foundation course, 8,335.4 feet on the second course, and 94.9 feet on the third course.

There have been used in this work 215,743.88 square yards of brush mattresses and 41,107.94 cubic yards of riprap stone.

South jetty.—The shore end of this jetty is located on Amelia Island, about 5,800 feet E. 18° S. from the eastern bastion of Fort Clinch. From this point it extends seaward a distance of 10,062.48 feet, measured along the axis of the work. From the initial point it runs as follows, viz:

	Feet.
Range 1, E	2,041.63
Range 2, N. 68° 32′ E	5,625.37
Range 3, N. 69° 32′ E	400.00
Range 4, N. 72° 32′ E	400.00
Range 5, N. 78° 32′ E	400.00
Range 6, N. 78° 32′ E	400.00
Range 7, N. 80° 2′ E	400.00
Range 8, N. 81° E	395.48

In addition to the foundation course a second course 3,967.9 feet in length extends seaward along the second range, beginning at a point 917.7 feet from the intersection of the first and second ranges.

The mattresses of the foundation course vary in width on the first range from 40 to 50 feet, and on the second range from 50 to 100 feet. On all other ranges their width is 100 feet, as is also that of the mattresses of the second course. The mattresses average about 18 inches in thickness, and are loaded with riprap stone to an average depth of 12 inches. This jetty has been brought up to the level of mean low water for a distance of nearly 3,123 feet from its shore end, and with a crest width of 16 feet shoreward of the angle and of 22 feet seaward of that point. The structure consists of riprap stone upon the mattress foundation. A hearting of oyster shells was tried, but being found to be disadvantageous and not economical was discontinued. The stone has stood well, the slopes assumed on both sides of the jetty being about 1 on 1¼. No breaking down of the work at any point has been observed. There have been used in the work 145,197.86 square yards of mattresses, 74,010.47 cubic yards of riprap stone, and 2,071.80 cubic yards of oyster shells.

Up to July 1, 1893, the total expenditures on both jetties, including outstanding liabilities, amounted to $761,914.92.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

The annual examination was made in June.

CONDITION OF WORK JUNE 30, 1894.

An examination of the work and of the bar channel was made in June, 1894. The jetties were found to be in good condition. The least channel depth across the bar was found to be 14.1 feet; an increase of more than 1 foot, as compared with last year. The channel still crosses the south jetty and then extends seaward in an almost easterly direction. As compared with last year, the north shoal and the bar channel proper have advanced somewhat in a southerly direction.

COMMERCE AND NAVIGATION.

All the commerce of St. Marys, Ga., and 90 per cent of the commerce of Fernandina, Fla., are dependent upon water transportation through Cumberland Sound.

The Florida Central and Peninsular Railroad, terminating at Fernandina, besides traversing a fertile and well-timbered country, pierces also the Florida phosphate fields, and much of the rock from the phosphate mines is brought by this road to Fernandina shipment to coastwise and foreign ports. For the handling of this increased traffic the railroad has built new wharves, erected a large elevator, and extended its terminal facilities. From information derived from the owners of the principal mines it is estimated that the annual shipments of rock will aggregate about 300,000 tons.

The Mallory Line has two steamships per week plying between Fernandina and New York, which carry annually about 61,000 tons of freight. Fifteen steamers per week ply between Fernandina and local coastwise ports, and a large fleet of foreign and coastwise vessels is engaged in the commerce of this port.

In 1893 the shipments, foreign and coastwise, amounted to 245,262 tons, valued at $2,217,250, and the receipts by water were 161,900 tons, valued at $7,001,000.

MISCELLANEOUS.

This work is located in two collection districts, the north jetty being in the district of St. Marys, Ga., and the south jetty in that of Fernandina. Fernandina, Fla., is the nearest port of entry. Amount of duties collected at Fernandina in 1893, $96.30; at St. Marys, none. Amelia Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

Since the existing project for improving Cumberland Sound was adopted the following appropriations have been made for this work:

By act of Congress of—	
June 14, 1880	$30,000
March 3, 1881	100,000
August 2, 1882	50,000
July 5, 1884	75,000
August 5, 1886	112,500
August 11, 1888	112,500
September 19, 1890	112,500
July 13, 1892	170,000
Total	762,500

The total expenditures to June 30, 1893, including all outstanding liabilities, were $762,500.

It is proposed to expend the funds available and any funds that may become available during the year in extending and raising the south and north jetties, the work to be done in accordance with the revised project of March 11, 1891.

The appropriations heretofore made have been entirely inadequate to an economical and advantageous prosecution of the work of improvement. The most satisfactory results can not be obtained with expenditures the next fiscal year of less than $1,000,000.

Money statement.

July 1, 1893, balance unexpended	$755.27
June 30, 1894, amount expended during fiscal year	755.27
Amount (estimated) required for completion of existing project	1,817,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,000,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Fernandina, Fla., from January 1, 1875, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875...	212	117, 363	4, 192	47	10, 379	359	12	7, 437	135	271	135, 179	4, 686
1876...	210	141, 354	4, 749	25	4, 893	179	28	9, 232	249	263	155, 479	5, 177
1877...	150	100, 581	3, 343	31	3, 768	217	40	12, 547	404	221	121, 896	3, 964
1878...	183	120, 845	3, 900	17	3, 985	101	22	8, 294	215	222	133, 124	4, 216
1879...	205	133, 020	4, 133	28	10, 634	252	10	5, 639	126	243	149, 293	4, 511
1880...	270	146, 722	4, 470	34	22, 396	598	22	9, 463	240	326	180, 581	5, 308
1881...	273	171, 548	4, 186	17	11, 899	314	24	11, 563	271	278	195, 040	4, 771
1882...	239	146, 383	3, 279	16	9. 056	242	15	6, 639	151	270	162, 078	3, 672
1883...	183	96, 937	2, 453	6	1, 769	43	14	5, 229	137	203	103, 935	2, 633
1884...	176	105, 061	2, 864	3	865	21	10	4, 029	88	189	109, 755	2, 973
1885...	169	111, 698	3, 131	7	999	47	22	9, 785	210	198	122, 482	3, 388
1886...	265	147, 418	4, 014	7	2, 112	53	15	5, 187	146	227	154, 717	4, 213
1887...	349	317, 798	5, 030	19	6, 402	122	22	8, 565	220	390	332, 965	5, 372
1888...	274	179, 130	4, 456	19	7, 152	156	18	6, 789	177	311	193, 071	4, 789
1889...	262	164, 229	3, 908	48	16, 434	369	39	12, 936	363	349	193, 594	4, 640
1890...	267	172, 202	3, 948	40	14, 683	305	33	11, 518	306	340	198, 403	4, 559
1891...	226	164, 588	3, 530	18	6, 175	140	34	17, 654	433	278	188, 417	4, 103
1892...	247	189, 855	3, 760	26	10, 027	195	54	39, 487	805	327	239, 361	4, 760
1893...	218	171, 595	3, 349	17	6. 779	166	52	34, 824	750	287	213, 198	4, 265

CLEARED.

1875...	229	121, 028	4, 303	31	8, 239	228	15	5, 343	212	275	134, 610	4, 743
1876...	244	161, 154	5, 058	21	6, 040	147	26	9, 002	269	291	166, 196	5, 474
1877...	165	106, 615	3, 590	24	6, 340	166	42	13, 741	412	231	126, 596	4, 168
1878...	195	124, 883	4, 086	19	4 911	123	26	9, 080	236	240	138, 874	4, 445
1879...	175	129. 654	4, 079	31	11, 067	258	12	8, 016	164	218	148, 737	4, 501
1880...	244	155, 659	4, 505	31	14, 207	327	24	10, 202	240	299	180, 068	5, 072
1881...	204	138, 593	3, 730	41	22, 007	506	31	15, 335	351	276	175, 940	4, 587
1882...	217	136, 666	3, 166	39	15, 497	370	31	14, 962	321	287	167, 125	3, 857
1883...	153	85, 815	2, 245	32	8, 925	210	24	9, 413	231	209	94, 153	2, 686
1884...	178	104, 462	2. 688	27	8, 831	176	15	6, 488	158	210	119, 781	3, 022
1885...	185	112. 936	2, 570	33	10, 251	249	21	9, 393	221	239	132, 580	3, 040
1886...	214	153, 092	4, 208	27	9, 072	200	26	9, 817	299	267	171, 981	4, 707
1887...	306	326, 342	4, 500	29	8, 552	232	33	11, 607	327	368	346, 501	5, 059
1888...	280	175, 490	4. 586	28	9, 190	184	20	8, 622	204	328	193, 302	4, 974
1889...	298	181, 075	4, 240	46	13, 652	342	45	16, 286	428	389	211, 013	5, 010
1890...	276	176, 330	4, 074	41	14, 394	317	34	13, 149	319	351	203, 873	4, 710
1891...	228	156, 272	3, 507	18	6, 407	136	49	31, 117	702	295	193, 796	4, 345
1892...	244	183. 840	3. 668	23	8, 784	174	77	58, 428	1, 116	344	329, 352	4, 958
1893...	191	137, 724	2, 761	17	6, 605	137	75	63, 347	1, 224	288	207, 676	4, 122

Arrivals and clearances of vessels and commerce at Fernandina, Fla., etc.—Continued.

COMMERCE.

Year.	Value of exports.		Value of imports.		Total commerce.	Duties collected.
	Foreign.	Coastwise.	Foreign.	Coastwise.		
1875	$209, 791	$1, 119, 979	$14, 304	$755, 718	$2, 089, 792	$1, 817. 84
1876	226, 076	1, 170, 240	46, 179	1, 131, 032	2, 573, 827	2, 181. 40
1877	310, 225	676, 855	19, 304	1, 146, 363	2, 152, 747	2, 376. 00
1878	248, 000	780, 607	8, 142	172, 234	1, 901, 983	2, 090. 00
1879	275, 470	921 368	11, 038	1, 360, 432	2, 568, 308	3, 424. 00
1880	257, 780	667 092	3, 676	1, 365, 857	2, 294, 405	7, 808. 00
1881	242, 100	064, 394	11, 791	1, 786, 546	3, 104, 831	8, 183. 00
1882	292, 400	1, 342, 421	45, 702	7, 536, 588	3, 217, 201	36, 590. 00
1883	248, 600	2, 573, 010	11, 229	2, 262, 755	5, 095, 594	5, 566. 00
1884	173, 600	1, 164, 462	1, 874	1, 738, 620	3, 078, 556	1, 331. 00
1885	214, 726	2, 134, 541	4, 180	1, 502, 544	3, 855, 991	1, 451. 28
1886	191, 595	2, 843, 000	590	1, 625, 000	4, 660, 185	808. 00
1887	226, 960	3, 500, 000	23, 896	2, 000, 000	5, 750, 856	3, 400. 00
1888	175, 150	2, 500, 000	....	650, 000	3, 325, 150	4, 655. 06
1889	325, 980	3, 970, 180	601	3, 150, 000	7, 446, 761	4, 712. 40
1890	478, 475	2, 245, 753	10, 902	4, 997, 683	7, 732, 813	7, 335. 32
1891	778, 251	1, 708, 276	....	2, 938, 000	6, 424, 527	None.
1892	1, 389, 043	1, 125, 543	701	6, 500, 000	9, 015, 287	3, 604. 22
1893	1, 412, 920	1, 804, 330	214	7, 000, 786	9, 218, 250	96. 30

JAMES A. PINE,
Collector.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

Arrivals and clearances of vessels and commerce at St. Marys, Ga., from January 1, 1879, to December 31, 1893.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1879	53	16, 773	378	6	2, 303	54	14	5, 155	143	73	24, 231	475
1880	30	8, 982	204	2	694	17	16	6, 409	185	48	16, 085	404
1881	22	7, 541	156	6	2, 491	54	25	11, 282	290	53	21, 324	500
1882	28	0, 504	196	1	371	7	15	5, 723	146	44	16, 598	347
1883	26	9, 596	132	3	1, 207	24	6	2, 112	44	35	12, 912	250
1884	32	11, 294	224	1	539	9	6	2, 334	57	39	14, 065	290
1885	40	13, 042	280	1	396	8	5	2, 028	52	46	15, 466	340
1886	20	7, 882	140	1	321	7	6	2, 086	56	27	10, 288	203
1887	37	13, 247	222	1	405	9	8	4, 286	90	46	17, 938	321
1888	55	20, 897	440	1	433	8	3	1, 365	32	36	22, 695	489
1889	60	24, 000	540	9	3, 575	70	14	5, 571	133	83	33, 146	743
1890	39	16, 328	300	6	2, 058	45	7	2, 856	68	52	21, 242	413
1891	44	18, 578	322	1	330	8	2	747	20	47	19, 655	350
1892	68	29, 417	540	9	3, 283	68	6	3, 177	64	83	35, 877	672
1893	54	23, 485	432	5	2, 172	40	2	663	18	61	26, 320	432

CLEARED.

1879	53	16, 773	378	10	3, 577	83	14	5, 155	143	77	25, 505	604
1880	30	8, 982	202	3	1, 150	27	12	4, 979	132	45	15, 111	361
1881	22	7, 541	156	7	3, 362	68	29	12, 463	323	58	23, 336	547
1882	28	10, 504	196	4	1, 567	32	18	6, 791	175	50	18, 862	403
1883	26	9, 596	182	3	1. 207	24	6	2, 112	46	35	12, 915	252
1884	32	11, 294	224	2	1, 097	19	6	2, 234	57	40	14, 625	300
1885	40	13, 042	280	3	1, 195	25	4	1, 595	42	47	15, 732	347
1886	20	7. 882	140	5	2, 312	40	5	1, 646	45	30	11, 840	210
1887	37	13. 247	222	1	425	9	8	4, 286	90	8	4, 286	90
1888	56	21, 330	448	5	2, 086	41	5	1, 587	46	66	25, 273	535
1889	60	24. 000	540	9	3, 575	70	14	5, 571	133	83	33, 146	743
1890	39	16, 323	300	3	877	21	7	1, 856	68	10	3, 733	89
1891	1	1	1	5	2, 265	38	2	818	18	7	3, 083	56
1892	68	29, 417	540	7	3, 089	57	6	3, 177	64	81	35, 683	661
1893	59	25, 225	464	5	2, 061	41	3	1, 152	29	67	28, 438	534

Arrivals and clearances of vessels and commerce at St. Marys, Ga., etc.—Continued.

COMMERCE.

Year.	Value of exports.	Year.	Value of exports.
1879	$82,491	1887	[illegible]
1880	70,411	1888	[illegible]
1881	149,333	1889	[illegible]
1882	47,216	1890	[illegible]
1883	26,902	1891	[illegible]
1884	22,517	1892	[illegible]
1885	27,127	1893	[illegible]
1886	36,520		

WM. A. WHITE,
Collector.

Capt. O. M. CARTER,
Corps of Engineers, U. S. A.

Shipments and receipts, port of Fernandina, Fla., 1893.

Articles.	Quantity.	Tons.	Value.
SHIPMENTS.			
Foreign:			
Lumber ... feet	11,940,743	23,982	[illegible]
Phosphate rock ... tons	....	126,100	[illegible]
Shingles ... number	161,900	60	[illegible]
Coastwise:			
Lumber ... feet	44,278,900	88,550	[illegible]
Phosphate rock ... tons	....	700	[illegible]
Cotton ... bales	420	80	[illegible]
Rosin ... barrels	5,242	1,400	[illegible]
Spirits turpentine ... do	984	200	[illegible]
Cedar ... cases	8,400	2,100	[illegible]
Shingles ... number	2,811,056	110	[illegible]
Palmetto fiber ... tons	....	50	[illegible]
Creosoted lumber and piles ... feet	220,000	500	[illegible]
Cotton-seed oil ... barrels	1,863	450	[illegible]
Oysters and fish ... cases	3,730	380	[illegible]
Total	....	245,262	[illegible]
RECEIPTS.			
Steel rails	....	145,000	[illegible]
Guano	....	1,300	[illegible]
Coal	....	1,600	[illegible]
Salt	....	1,000	[illegible]
Merchandise	....	13,000	[illegible]
Total	....	161,900	[illegible]
Aggregate	....	407,162	[illegible]

N 12.

IMPROVEMENT OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA.

The location of this route is shown by a dotted line on Coast Survey charts Nos. 156 and 157, and a detailed description of it is given in my report of a survey dated November 25, 1891, which is printed as part of Appendix N 12, Annual Report of the Chief of Engineers for 1892, pp. 1311 to 1326.

The distance from Savannah to Fernandina by the inside route just described is about 160 miles.

Touching at Darien en route increases the distance by about 20 miles, and at Brunswick by about 12 miles.

ORIGINAL CONDITION.

The route leaves the Savannah River by St. Augustine Creek, and following Wilmington River reaches Romerly Marsh, through which two routes exist—the old one through Romerly Marsh Creek, very crooked and narrow and almost impracticable at low water, and the new route through Dead Mans Hammock Creek and the dredged cut connecting the same with Wassaw Creek, through the latter and Odingsell River to Adams Creek, where it joins the first route. From Romerly Marsh the route traverses the following streams or portions of them, viz: Adams Creek, Vernon River, Ogeechee River, Florida Passage, and Bear River; then crosses St. Catherines Sound and follows North Newport River (or Walburg Creek), Johnsons Creek, and South Newport River into Sapelo Sound. In all parts of the route just described, south of Romerly Marsh, the depths exceed 7 feet at mean low water, ranging generally from 10 to 20 feet and often exceeding the latter depth.

On leaving Sapelo Sound the most serious obstruction of the entire route is found in the long stretch of shallow water in Mud River. For a distance of more than 3.5 miles the depth is less than 7 feet, the mean depth is 5.8 feet, and the least depth 4.8 feet, all referred to mean low water. From Mud River the channel follows New Teakettle Creek, crosses Doboy Sound, and enters North River, thence through a portion of Rockdedundy River reaches Little Mud River, in which there is a shoal of small extent carrying slightly less than 7 feet at mean low water. Crossing the Altamaha Sound, the channel continues through Buttermilk Sound and Frederica Creek into St. Simon Sound. About 1 mile north of Frederica Landing the channel is narrow and is partially obstructed by oyster beds.

Entering Jekyl Creek from St. Simon Sound two shoals are encountered, one just outside the entrance and the other inside, at the point where the creek widens. The least mean low-water depths on those shoals are 4.8 feet on the former and 5.3 feet on the latter. The route crosses St. Andrews Sound by a detour seaward around the middle ground, and thence by way of Cumberland River and Cumberland Sound reaches Fernandina, Fla.

From Jekyl Creek southward the depths are ample, exceeding in most places 10 feet at mean low water, and navigation is easy, except at one point, known as "The Dividings," at the mouth of Crooked River. At that point a sharp turn of more than 100 degrees is made by the channel in passing the Horseshoe Shoal. The least channel depth is, however, fully 7 feet at mean low water, and greater depths are found on either side of the shoal. Were the channel properly marked by ranges and buoys no difficulty in navigating it should be experienced.

PLAN OF IMPROVEMENT.

The existing project of improvement, adopted in 1892, provides for the establishment of a channel 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek, by means of dredging and the construction of closure dams and training walls of brush mattresses loaded with riprap stone. The estimated cost of the improvement is $105,000, provided that the entire sum is made at once available.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1893.

Work so far has been entirely confined to Jekyl Creek, under a contract awarded March 1, 1893, to the Atlantic Contracting Company. There were put into the training wall 17,170.97 square yards of brush mattresses and 1,252.51 cubic yards of riprap stone.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

The annual examination was made in June.

CONDITION OF WORK JUNE 30, 1894.

The training wall at the mouth of Jekyl Creek is in good condition, and the channel depth over the bar alongside of it has not changed materially since last report

COMMERCE AND NAVIGATION.

The inside route is of great value to the coasting trade between Savannah and Fernandina and intermediate points. Full information in regard to this subject, together with such statistical data as could be obtained, will be found in the Report of the Chief of Engineers for 1883, pp. 1605 and following.

MISCELLANEOUS.

This work is located in the collection districts of Savannah, Brunswick, St. Marys, Ga., and Fernandina, Fla. The amount of duties collected in 1893 was $56,661.[illegible]; $5,768; nothing, and $96.30, respectively. The nearest light-houses are those upon the Savannah River, near the beginning, and Amelia Light, at the end of the route, with Sapelo, Wolf Island ranges, St. Simons, and Little Cumberland lights between. Forts Oglethorpe and Pulaski, Ga., and Clinch, Fla., are the nearest forts.

Since the existing project for improving this route was adopted, one appropriation of $15,000 has been made, although three appropriations, aggregating $20,000, have been made for the improvement of Jekyl Creek, one part of the route needing improvement.

The total expenditures under this present project up to June 30, 1894, including all outstanding liabilities, were $15,000.

It is proposed to expend any funds which may become available during the year in executing works of improvement outlined in my report of November 25, 1891.

The sum of $90,000 can be advantageously and economically expended during the coming year. Unless the sum asked for is appropriated at once the cost of the work will be greatly increased.

Money statement.

July 1, 1893, balance unexpended	$14,653.31
June 30, 1894, amount expended during fiscal year	14,653.31
Amount (estimated) required for completion of existing project	90,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	90,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

N 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK OF THE AUSTRIAN BARK UNDINE, SAVANNAH HARBOR.

This work being deemed an obstruction to navigation and the attempts of her owners to raise her being abandoned, authority to remove her was granted by the Secretary of War on May 6, 1893, an allotment of $4,000 being made for that purpose. The contract was awarded to Messrs. Johnston & Townsend, of Somers Point, N. J., for the sum of $3,645. Work was commenced by the contractors on July 31 and completed on August 26, 1893. The wreck was removed by closing leaks and then pumping out enough water and mud to float it, when it was towed to a suitable place, sunk, and abandoned. Considerable difficulty was experienced in stopping enough of the leaks to permit the pumping out of the hold, but the work was at last satisfactorily completed. The spars were loosened by small charges of dynamite and then removed by hand.

WRECK OF THE STEAMER DAVID CLARKE AND SEVERAL UNKNOWN WRECKS IN SAVANNAH HARBOR.

Authority was granted April 7, 1894, by the Secretary of War for the removal by hired labor and purchase of material in open market of several wrecks in Savannah Harbor, between the city and Oyster Bed Red Light. The snag boats *Toccoa* and *Satilla* were engaged on this work from time to time as they could be spared from the work. Up to the end of the fiscal year there were removed entirely the wreck of the steamer *David Clarke*, the sunken tugboat *Leon*, both at Garden Bank, and the wreck of a pilot boat near the head of South Channel. There were partially removed the unknown wreck in Wrecks Channel and the two unknown wrecks near Red Light and Oyster Bed Shoal. This work will be completed during the next fiscal year.

The total expenditures during the fiscal year, including outstanding liabilities, amounted to $8,481.26.

APPENDIX O.

IMPROVEMENT OF RIVERS AND HARBORS IN FLORIDA.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. THOS. H. HANDBURY AND LIEUT. A. M. D'ARMIT, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. St. Johns River, Florida.
2. Upper St. Johns River, Florida.
3. Volusia Bar, Florida.
4. Ocklawaha River, Florida.
5. St. Augustine Harbor, Florida.
6. Indian River, Florida.
7. Northwest entrance, Key West Harbor, Florida.
8. Caloosahatchee River, Florida.
9. Charlotte Harbor and Pease Creek, Florida.
10. Sarasota Bay, Florida.
11. Manatee River, Florida.
12. Tampa Bay, Florida.
13. Withlacoochee River, Florida.
14. Harbor at Cedar Keys, Florida.
15. Suwanee River, Florida.

United States Engineer Office,
St. Augustine, Fla., July 9, 1894.

General: I have the honor to inclose herewith the annual reports for the fiscal year ending June 30, 1894, pertaining to the works of river and harbor improvements now in my charge. From the beginning of the year until May 15, 1894, these works were in the temporary charge of Second Lieut. Albert M. D'Armit, Corps of Engineers, U. S. Army.

Very respectfully, your obedient servant,

Thos. H. Handbury,
Major, Corps of Engineers.

Brig. Gen. Thomas L. Casey,
Chief of Engineers, U. S. A.

O 1.

IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

The portion of the river under improvement from Jacksonville to the ocean may be divided into four reaches, as follows:

1. Jacksonville to Dames Point: Length, 12.4 miles; average channel width between 20-foot contours, 1,100 feet; between 15-foot contours, 1,300 feet; minimum 15-foot channel width, 550 feet; minimum mid-channel depth, 20 feet; mean range of tide, 1.4 feet.

2. Dames Point to Beacon No. 1 (1 mile below St. Johns Bluff): Length, 7.5 miles; aggregate length of channels less than 15 feet deep, 1.3 miles; average width of these channels between 9-foot contours, 400 feet; minimum mid-channel depth of defective portions, 12.5 feet; minimum mid-channel depth of remainder of reach, 15 feet; range of tide, 2.72 feet.

3. Beacon No. 1 to mouth: Length, 5 miles; average width between 20-foot contours, 700 feet; between 15-foot contours, 870 feet; minimum mid channel depth (except at one place 1 mile long), 20 feet; depth at excepted place, 15 feet; range of tide, 4.34 feet.

4. Mouth to outer bar: Distance, 2.5 miles. Before the improvement was begun this was crossed by shifting channels from 2.1 to 2.5 miles long and having a mean low-water depth of from 5 to 7 feet. The tidal range on the outer bar is 5.8 feet.

PROJECT OF IMPROVEMENT.

The operations for improving this channel have been carried on in accordance with a project submitted to the Chief of Engineers June 30, 1879, by the late Gen. Q. A. Gillmore, colonel, Corps of Engineers, and printed as part of Appendix I 7, Annual Report of the Chief of Engineers for 1879.

The approved project is to obtain a least mid-channel depth of 15 feet at mean low water from Jacksonville to the ocean. This depth is to be obtained across the bar by concentrating and directing the flow of the river by two long jetties, starting from opposite shores of the entrance and converging until, near their outer extemities on the bar, they shall be 1,600 feet apart. The jetties are to be built of riprap stone on mattresses of log or brush and suitably capped. In this project the estimated length of the north jetty was 9,400 feet and the south jetty 6,800 feet. It was estimated that the cost of these would be $1,306,409.

The estimated cost of improving the river from the bar to Jacksonville so as to give a low-water depth throughout of 15 feet was $120,000.

The following appropriations have been made for this work:

By act approved—	
June 14, 1880	$125,000
March 3, 1881	100,000
By act passed August 2, 1882	150,000
By act approved—	
July 5, 1884	150,000
August 5, 1886	150,000
By act passed August 11, 1888	175,000
By act approved—	
September 19, 1890	170,000
July 13, 1892	112,500
By sundry civil act approved March 3, 1893	284,500
Total	1,417,000

The act of July 13, 1892, authorized a contract to be made for the completion of the work at the mouth of the river, the amount of the contract not to exceed $397,000. The sundry civil act approved March 3, 1893, contained the item of $284,500 for completing the work.

The increased cost of the work over the original estimate is $110,591. This is attributable to the fact that for many years during the early part of its progress long and frequent intermissions were made necessary by reason of a want of adequate appropriations for carrying on a work of this magnitude. Under these circumstances favorable contracts could not be made and the uncompleted work was subject to great deterioration during these suspensions.

From the year 1865 to the adoption of the project in 1879 a sum aggregating $57,476.38 had been expended in dredging for temporary improvement of the bar channel. For making preliminary surveys and preparing the project the sum of $2,523.74 was expended.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

Under the provisions of the contract entered into with I. H. Hathaway & Co., under date of November 30, 1892, there were placed upon the south jetty 3,920.6 tons of first-class stone, 24,167.8 tons of second-class stone, and 41,030.5 tons of third-class stone.

In the specifications forming a part of this contract provision is made for the use of three classes of stone. The first class being stone weighing not less than 165 pounds to the cubic foot and in blocks weighing from 1 to 6 tons, 50 per cent to weigh 4 tons or over. The second-class stone weighs not less than 150 pounds to the cubic foot and in pieces weighing from 20 to 400 pounds. The third-class stone weighs not less than 120 pounds nor more than 150 pounds to the cubic foot and in pieces weighing from 15 to 300 pounds.

The third-class stone on the mattress forms the foundation and also the hearting of the superstructure. The second-class stone forms a covering for the third-class stone and a bed for the first-class stone, which forms the capping at the height of mean low water.

The foundation course of matting for the south jetty was extended during the year from Station 9498 to Station 10712, a distance of 1,214 feet, making the total length of this jetty 11,192 feet. This includes the shore approach of 480 feet. In matting the foundation for the year 15,673 square yards of mattress work were used.

No work was done on the north jetty during the year.

For the purpose of ascertaining the condition of the channel over the bar and the effect of the work being done monthly hydrographic surveys have been made. A map made from the last of these, June 28, 1894, is herewith transmitted.

The work of closing the sailing gap in the south jetty through which vessels passed out and in, finding a little better water by that course than directly out between the jetties, was commenced June 11. A large body of water was passing out during ebb tide through this opening. It was deemed advisable to direct this upon the bar and transfer its erosive effect to that channel.

PRESENT CONDITION OF THE JETTIES.

South jetty.—The foundation of this jetty is now at Station 10712, which is as far out as it is at present contemplated to extend it. At this point it now rests on the outer slope of the bar in 24 feet of water.

The crest of the jetty from Station 1500 back to the shore slopes from mean low to mean high water. From Stations 1500 to 3500 it is at mean low water; thence to near Station 7000 it will average about 2 feet below low-water line. From 7000 to 7500 it is 5 feet below, and from thence to about 8500 it is near the mean high-water line; from thence to 10300 it is 1 foot below mean low water; thence it slopes off rapidly to the bottom at the end of the foundation. It is proposed to raise this jetty throughout to about the mean high-water line with the expectation that with the settling and the adjustment of its material under the action of the waves it will finally rest about 3 feet above mean l water line.

North jetty.—No work has been done on this jetty since Decemb 1891. Its foundation at that time was out as far as Station 10934. is not contemplated at this time to extend this further. The crest this jetty from the shore end out to Station 7000 is now at mean l water. From this station to Station 8500 it will average 2 feet bel low water, and from 8500 to the end the average is 6 feet. Until t south jetty has been raised to its full height and the effect produc carefully observed, it can not be definitely determined what furth work, if any, will be necessary upon the north jetty.

CHANGES SINCE LAST ANNUAL REPORT AS SHOWN BY COMPARIS OF SURVEYS.

During the last week in June a careful survey was made of the b and its vicinity for the purposes of this annual report. Comparing th with similar survey made the preceding June, marked change, due t the jetties, will be observed.

The south jetty has in the meantime been extended 1,200 feet. T crest of the bar has moved out 400 feet. The 30-foot curve h remained practically the same. The outer 24-foot curve has advanc about 200 feet, and the 15 and 18 foot curves about the same distanc The area between the outer ends of the jetties and the deep water h been materially deepened. The average over the whole is probab not less than 2 feet. The deepest water over the bar at mean low wat last year did not exceed 7 feet. This year we find 11 feet. The 15-f curve on the inside, between the jetties, has advanced 500 feet wh the 18-foot curve has gone forward but 200 feet.

This comparison shows very encouraging results and gives eve assurance of the ultimate success of the works. Had it been practic ble to have closed the sailing gap in the south jetty earlier in th season there is no doubt but there would now be a better straight c channel between the jetties. This was left open until the last mom because of the better water found on the south side of the south je which pilots wished to take advantage of, and for the convenience the contractor in moving his boats about the work.

IMPROVEMENT OF THE RIVER BETWEEN THE BAR AND JACKSO VILLE, FLA.

The project of 1879, as stated above, provided for the improvem of this portion of the river so as to give a navigable ship channel low water nowhere less than 15 feet. At the instance of the citiz of Jacksonville a project with estimate of cost was prepared by predecessor in permanent charge of this office, which provided f navigable ship channel having a low-water depth of 18 feet from bar to that city. The cost of carrying this project into execution estimated at $324,000. The citizens of Duval County, Fla., in wh Jacksonville is situated, realizing the immense advantage that depth of water would be to their commerce and to the development the resources of their State, as well as the fact that aid from the G eral Government for such enterprises comes sparingly and at protrac intervals, by permission of their State legislature, determined to b their county to the extent of $300,000 for the purpose of at once ca ing this project into execution. The act of the State legislature

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UNIV. OF MICH.

ided that this matter should be under the control of a board of trustees.

On the 28th of March, 1892, the project for the improvement was pproved by the Secretary of War, and under necessary restrictions nd regulations these trustees were permitted to proceed with the vork.

They employed as their engineer Mr. J. H. Bacon, who for some time ad been employed as U. S. assistant engineer in charge of various urveys and works of improving rivers in Florida.

The operations of the board of trustees extended from Dames Point o Mile Point, a distance of 10 miles, measured on the channel line, nd includes all those portions of the river between the bar and acksonville, in which a navigable channel with a depth of 18 feet at ow water could not be found.

This work was commenced in July, 1892, and finished by the end of ay, 1894. Mr. Bacon, the engineer for the board of trustees, has indly furnished me for incorporation with this annual report a full report f their operations, together with a tracing from a map of that portion f the river covered by them, showing the present condition of the hannel. For further details respecting this work attention is respectully invited to this report.

Money statement.

uly 1, 1893, balance unexpended	$386, 541.95
une 30, 1894, amount expended during fiscal year	147, 338.43
uly 1, 1894, balance unexpended	239, 203.52
uly 1, 1894, amount covered by uncompleted contracts	215, 542.48
uly 1, 1894, balance available	23, 661.04

EPORT OF MR. J. H. BACON, ENGINEER IN CHARGE OF WORK DONE BY DUVAL COUNTY, FLA.

JACKSONVILLE, FLA., *June 15, 1894.*

MAJOR: I have the honor to submit the following report on the improvement of he St. Johns River, Fla., by Duval County.

The history of this work is as follows:

In 1891 the county of Duval voted to issue bonds to the extent of $300,000 for the urpose of improving the St. Johns River between Jacksonville and the bar at the outh. This fund was placed in charge of 12 trustees for disbursement. A project o secure an available mean low-water channel 18 feet deep and 200 feet wide etween the points named was prepared by Maj. J. C. Mallery, Corps of Engineers, . S. Army.

The contracts were let in May, 1892. Mr. R. G. Ross, contractor for dike work, egan operations in July, 1892, and finished the work, as originally laid out, in Jan-ary, 1893. Subsequently it was decided to expend $20,000 of the balance of 25,000 on hand after the completion of the dredging, in constructing a training all to protect the cut at Cedar Creek. Mr. Ross undertook this work at the same rices offered in his original bid. He began the construction of the wall on April , 1894, and finished on May 31, 1894.

All dike work consisted of a foundation mattress of brush covered with riprap tone. On this was built a mound of shell which was weighted down with stone. ll mattresses were laid continuously and consisted of one layer of brush fascines laced close together and held in position by binders of heavy wire. The binders vere 6 feet apart.

The Cedar Creek training wall was built up to the height of 8 feet below mean ow water; all others to the height of 1 foot above mean low water. St. Johns luff, which had been continuously wearing away, was protected by a mattress of rush 60 feet wide, covered with riprap; a small portion was covered with shell.

The lowest bidder for the dredging was Mr. J. A. Bryan, of Riverview, Fla., wh sublet the work to the San Francisco Bridge Company. All of the dredging wa done by this company and by its successor, the New York Dredging Compan They began work in January, 1893, and finished in March, 1894. All cuts we dredged to a depth of 18 feet at mean low water and a width of 200 feet. Only o dredge was used. This was provided with a pump having a 20-inch suction and 20-inch discharge. All material was pumped ashore through pipes.

At present, all of the dams and training walls are in the same condition that th were in a year ago, and there has been no erosion at St. Johns Bluff since the sho protection there was completed. All of these structures, therefore, may be consider permanent, and in no danger of needing repair. My observation, however, of th action on the currents of the dams and training walls has convinced me that all o them should be built up to above high water, and that the Dames Point trainin wall should be extended.

The cuts are all in good condition and afford an available mean low-water dep of 18 feet between Jacksonville and the bar. There has been some shoaling on th edges, owing to the fact that the sides, which had been left vertical by the dredg have assumed a natural slope. This shoaling is most apparent in the second range the Dames Point cut, where the original depth was from 6 to 8 feet. A sheet is sub mitted with this report showing comparative cross sections on this range. Thr profiles are shown on each 6 cross sections; one showing the bottom immediate before dredging was begun, one showing the bottom immediately after dredging wa completed, and one showing the bottom in May, 1894, a year later.

For future work I would respectfully make the following recommendations, th work to be done in the order named:

1. To widen the first and second ranges of the Dames Point cut to a width of 3 feet.
2. To extend the Dames Point training wall 500 feet.
3. To raise all training walls and dams to a height of 1 foot above mean hig water, beginning with the Dames Point wall.
4. To extend and deepen the present cuts to the depth of 20 feet at low water, pr vided that this depth can be secured over the bar.
5. To form a new project with a view to securing ultimately a depth to Jackso ville of 24 feet at mean low water, provided that this depth can be secured over th bar.

Summary of dike work.

Location.	Length.	Mattress.	Stone.	Shell.
	Feet.	*Sq. yards.*	*Cub. yards.*	*Cub. yar*
Dames Point training wall	4,100	11,892.1	7,391.9	3,78
Island training wall	2,400	8,340.4	5,080.7	43
Cut-off dam	3,150	11,121.5	7,887.9	61
Coon Point dam	2,700	9,951.9	7,059.3	6,36
St. John's Bluff shore protection	4,750	29,196.1	6,746.4	99
Cedar Creek Jetty (abandoned)	165	583	353.3	....
Cedar Creek training wall	2,000	11,111.1	4,455.8	4,36
Total	19,265	82,196.1	38,975.9	16,6

Prices paid: Mattress, 48 and 50 cents per square yard; total cost, $39,807 Stone, $2.20 per cubic yard; total cost, $85,745.66. Shell, $1 per cubic yard; tot cost, $16,698.40. Total cost of dike work, $142,251.99.

Summary of dredging.

Location.	Length.	Measure in situ
	Feet.	*Cub. yar*
Dames Point cut	8,815	67,
St. Charles Creek cut	4,687	111,
Browns Creek cut	3,965	65,
Cedar Creek cut	2,588	72,
Mile Point cut	3,963	72,
Total	24,018	736,

Total cost at 18 cents per cubic yard, measured in situ, $132,532.38.

The money statement for this work on May 31, 1894, was as follows:

Proceeds from sale of bonds	$305,206.25
Total cost of dike work	142,251.99
Total cost of dredging	132,532.38
Total cost of contract work	274,784.37
Engineering and contingencies	24,164.92
Balance May 31, 1894	6,256.96
	305,206.25

Very respectfully, your obedient servant,

J. H. Bacon,
Engineer in Charge.

Maj. Thos. H. Handbury,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Commerce of St. Johns River, Florida, during the year ending December 31, 1893.

[Furnished by Mr. Charles H. Smith, secretary Board of Trade, Jacksonville, Fla.]

Articles.	Gross tonnage.	Estimated value.
Cotton, sea island and upland	2,302	$116,455
Fertilizers	25,000	80,000
Fruits, viz, bananas, etc	500	13,500
Hides	100	14,000
Lumber, logs	200,000	98,000
Lumber, dressed, sawed	147,013	718,975
Merchandise	195,000	9,500,000
Oranges	29,371	760,340
Pineapples	720	38,400
Ship and naval stores	1,394	31,750
Vegetables	600	15,080
Shingles	30,000	180,000
Railroad ties	32,400	70,000
Coal	70,000	315,000
Cement	1,200	82,000
Fish and oysters	53	1,500
Tobacco	439	2,195,000
Total	736,092	14,180,000

Arrivals and departures of vessels for the year ending December 31, 1893.

Kind of vessels.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	192	289,639.22	184	285,550.37
Sailing vessels	153	43,969	150	42,603
Yachts	1	80		
Total	346	333,688.22	334	328,153.54

Belonging to this port and not included in the above: Steamers, 52; tons, 4,451.84. Sailing vessels, 21; tons, 2,131.29.

Estimated number of passengers carried by water, 40,000. Estimated percentage of total trade of neighborhood carried by water, 25 per cent. Probable increase of trade were the improvement completed, 300 per cent.

Comparative table of commerce of St. Johns River, Florida.

[Compiled from all available sources.]

Period.	Average number vessels per year.	Average tonnage per year.	Average per year
January 1, 1870, to December 31, 1874, 5 years	892	299,040	$1,6 [illegible]
January 1, 1878, to December 31, 1879, 2 years	664	280,455	Not obtai
January 1, 1880, to December 31, 1884, 5 years	758	250,173	‡3,48 [illegible]
July 1, 1884, to June 30, 1888, 4 years	*650	370,734	§4,57 [illegible]
January 1, 1889, to December 31, 1892, 4 years	†670	679,577	11,43 [illegible]
1893	680	736,092	11, [illegible]

* First 3 years only. † 1891 and 1892 only. ‡ Vessels and cargoes. § 1888 only

O 2.

IMPROVEMENT OF UPPER ST. JOHNS RIVER, FLORIDA.

The reach of this river which seems to be included within the authorized project for its improvement extends from the upper end of Lake George to the upper end of Lake Monroe. The difficulties to be overcome in order to improve navigation seem to be the Volusia Bar, where the river enters or widens out into Lake George, for the improvement of which small appropriations have been made, and some short bends in the river. It does not appear that these curves form obstructions to navigation, further than that the larger boats navigating the river have some difficulty in passing around them at full speed.

For the convenience of boats of this character a project for the improvement of these bends was submitted October 5, 1883. This contemplated dredging cut-off 100 feet wide at bottom with a depth of 5 feet at low-water stages. The estimated cost was $38,800. The details of this project will be found in the Report of the Chief of Engineers for 1884, p. 1140 *et seq.*

WORK DONE AND RESULTS OBTAINED.

An appropriation of $5,000 was made available for this work by the river and harbor act approved July 5, 1884. None has been made since.

No bids being received in answer to advertisements for proposals for doing this work the funds were held pending future appropriations. On April 2, 1892, the originial project was modified so that the amount available might be expended in removing the shoal points on the convex sides of the bends mentioned in the original project instead of dredging cut-offs as contemplated.

OPERATIONS PRIOR TO JUNE 30, 1893.

A contract for this work was entered into with Messrs. Marzyck & Browne, on December 30, 1892, and approved February 2, 1893. The work was to be done in connection with the work on improving Volusia Bar, Florida, at the price of 36 cents per cubic yard, measured in place. Work under this contract began March 16, 1893.

There is no dredging plant available for doing small quantities of work in comparatively isolated places on the east coast of Florida, and the small amount of work in prospect would not warrant a private party in building a suitable dredge, especially in view of the uncertainty of procuring the contracts. In this instance the contractor's plant proved inadequate for the work, and the progress was very slow. Up to the end of the fiscal year 2,006.7 cubic yards of material had been removed from two of the worst points at the upper bends, referred to in the project locally known as Wekiva Bend and Coxcetter's Bend.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

Work under the above contract was continued. It resulted in the removal of 9,397.5 cubic yards of material (place measurement) and a consequent improvement of the channel around the bends. The channel of the entire upper river is now fairly navigable with the exception of one bend, known as the "Revolving Bend," where no work has been done, as it is proposed to make a cut-off at this point as soon as funds become available. The material excavated was pumped back on shore, behind suitable retaining walls, is rapidly becoming covered with vegetation and presents a reasonable assurance of permanency.

Available funds were exhausted October 14, and the dredge was moved to Volusia Bar for work at that point.

It is recommended that Congress be asked to appropriate $5,000 for continuing this improvement.

This work is in the collection district of St. Johns. Jacksonville is the nearest port of entry. Nearest light-house is Volusia Bar Light. Nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1893, balance unexpended	$4,544.80
June 30, 1894, amount expended during fiscal year	4,240.51
July 1, 1894, balance unexpended	304.29
Amount (estimated) required for completion of existing project	33,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Commerce of Volusia Bar and Upper St. Johns River, Florida.

[Furnished by J. A. Leslie, superintendent Clyde Steamship Line.]

Articles.	Estimated value.	Gross tonnage.
Fruits (176,732 boxes)	$176,750	7,069
Fertilizers	76,160	2,240
Grain	61,730	1,852
Merchandise	536,200	5,362
Vegetables (13,227 boxes)	13,225	529
Hay	8,200	410
Railroad iron	6,270	209
Total	878,535	17,671

Commerce of Volusia Bar and Upper St. Johns River, Florida—Continued.

Vessels.	Character.	Tonnage.	Draft.
City of Jacksonville	Side-wheel steamer	460	4 feet, light.
Frederick De Barry	do	300	Do.
Everglade	do	420	Do.
Welaka	Stern-wheel steamer	300	2½-feet, light.

Estimated number of passengers carried by water, 10.000.

During the winter season the above boats make daily trips between Jacksonville and Sandford. In the summer months two round trips per week are made.

O 3.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

Volusia Bar is located at the south end or head of Lake George, about 162 miles by river from the mouth of St. Johns River, at the point where the waters of the river flow into the lake.

An examination of Volusia Bar with a view to its improvement was made in March, 1879. A report thereon, dated July 16, 1879, with a plan of improvement, is printed as Appendix I 9, Annual Report of the Chief of Engineers for 1879.

This was modified as reported in the Annual Reports of the Chief of Engineers for 1882 and 1883, Appendixes J 11 and L 14, respectively.

Before its improvement the channel over the bar was very crooked, and had a least depth varying from 3½ to 4½ feet.

APPROVED PROJECT.

To establish and maintain a channel 6 feet deep across the bar by the increased velocity of flow produced by two converging jetties of brush and stone, assisted by dredging, if necessary, and to define and protect the channel thus formed by rows of fender piles.

In 1887 this project was modified to limit the depth to the 5 feet already attained, as that depth is sufficient for the steamers navigating the Upper St. Johns River, and is as great as can be carried over the bars between Lake Monroe and Lake George.

WORK DONE AND RESULTS OBTAINED.

Operations for improving Volusia Bar, Florida, have been carried on at intervals since December, 1890, under the following appropriations.

By act of—	
June 11, 1880	$5,00
March 3, 1881	5,50
August 2, 1882	5,00
July 5, 1884	2,00
August 5, 1886	7,50
August 11, 1888	50
September 19, 1890	50
July 13, 1892	1,00
Total	27,00

Two jetties had been built, starting from opposite sides of the river bank at the south edge of the lake and converging until on the bar the clear channel way between them was 230 feet wide. The east jetty is 3,400 feet long, and is built to the level of mean low water for 2,930 feet from the shore. The west jetty is 2,200 feet long, of which a length of 1,940 has its crest at the level of mean low water. Two rows of firmly set piles provided with waling strips, confine boats to a 100-foot channel across the crest of the bar. In 1887 the depth attained was reported to be ample for the existing commerce.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

With the $1,000 appropriated July 13, 1892, repairs have been made to the fender piles at a cost of $225. Under contract with the same parties, Messrs. Marzyck & Browne, of Jacksonville, Fla., dredging was begun and finished in November, 1893. A total of 257.7 cubic yards of material, measured in place, were removed, making a cut 50 feet wide and 310 feet long, having a depth of 6 feet. Since the completion of this cut no complaints have been received.

A careful survey of this bar made in May, 1894, shows a good steamboat channel through it, having a depth practically 6 feet at extreme low water. During high water of the St. Johns River some sediment is brought down. Upon reaching the wide portion of its bed at this place it is deposited. If the fall is sudden this will interfere with navigation to a limited extent until the current has time to scour a channel through it.

An annual appropriation of $1,000 will be sufficient to repair the jetties and keep this bar in good navigable condition at all times.

This work is in the collection district of St. Johns. Jacksonville is the nearest port of entry. Nearest light-house is Volusia Bar Light. Nearest fort is Fort Marion.

Money statement.

July 1, 1893, balance unexpended	$1,062.46
June 30, 1894, amount expended during fiscal year	829.05
July 1, 1894, balance unexpended	233.41
Amount (estimated) required for maintenance of existing project	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

For commercial statistics see report for "Improvement of Upper St. Johns River, Florida."

O 4.

IMPROVEMENT OF OCKLAWAHA RIVER, FLORIDA.

The Ocklawaha River has its source in Lake Apopka, central Florida, flows slightly west of north for about 104 miles, measured along the axis of the channel, then almost due east for 21 miles farther, when it unites with the St. Johns River. The Ocklawaha River is the principal outlet of a number of large lakes, whose aggregate area is about 1 square miles.

The only important tributary of the Ocklawaha River is the Silv Springs Run, which is 6 miles long and has an average width of ab 50 feet and a least depth along the axis of the channel of abou feet. Being the outlet of the famous Silver Spring, its volume of di charge varies but little.

From Lake Griffin down for a distance of about 28 miles the riv flows through a wide savanna submerged about 1 foot under water a covered with a dense growth of saw grass. On this reach the riv averages from 30 to 40 feet in width and has a least channel depth about 5 feet: the current is very sluggish.

The impediments to navigation on this portion of the river are t numerous bends, the narrow channel, floating islands, and eelgrass.

From the savanna to the mouth, a distance of about 58 miles, th banks are covered with a dense growth of cypress and other timber.

On this reach the river averages from 60 to 70 feet in width, and th least channel depth is 4 feet. The average velocity of the current i considerably greater than on the upper river, being about 1.3 feet pe second.

The principal obstructions to navigation are snags and overhangin trees.

PROJECT OF IMPROVEMENT.

The project for the improvement of this river consists in removi snags, overhanging trees, floating islands, and other obstructions of lik character, so as to give a fair navigable channel of 4 feet depth fro the mouth to Leesburg, at the head of Lake Griffin, a distance of 9 miles. The estimated cost of this work is $26,000.

WORK DONE AND RESULTS OBTAINED.

The following appropriations have been made for this work:

Act of—	
September 19, 1890	$10,0
July 13, 1892	1,0
Total	11,0

These amounts were expended in removing snags and overhangin trees during fiscal years 1891, 1892, and 1893, resulting in the improvement of navigation on the stream as contemplated from the mouth u for a distance of about 60 miles. Above this point there are a few shoals and floating islands which it is desirable should be removed Railroads are practicably inaccessible to a large portion of residents along this part of the river.

The fruit and vegetable growers of this vicinity are largely dependent upon the river to transport their products and supplies. A continuance of the work to Lake Griffin is a matter of great importanc to them.

The Ocklawaha River is in the collection district of St. Johns. The nearest ligh house is the St. Augustine Light. The nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1893, balance unexpended	$1.7
June 30, 1894, amount expended during fiscal year	1.7

Amount (estimated) required for completion of existing project	$15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of Ocklawaha River, Florida, during the year ending December 31, 1893.

[Furnished by Mr. R. J. Adams, Palatka, Fla.]

Articles.	Gross tonnage.	Estimated value.
Cotton	3	$1,500
Fertilizers	312	9,360
Fruits	1	40
Grain	408.5	122,450
Hides	1.5	300
Honey, sirup, etc	33	1,320
Lumber, rough and dressed	57	1,140
Merchandise	828	82,800
Oranges	1,906	76,240
Vegetables	3	150
Wool	2	1,000
Total	3,555	296,300

Estimated number of passengers carried by Hart's Line, 5,120.

O 5.

IMPROVEMENT OF ST. AUGUSTINE HARBOR, FLORIDA.

St. Augustine Harbor lies on the east coast of Florida, about 47 miles south of the St. Johns River. It is formed by the junction of two rivers, or rather salt-water lagoons, the Matanzas and Tolomato rivers, which run parallel to the coast and there unite to break through the line of sand hills into the sea. The total length of the Tolomato is about 20 miles, and of that part of the Matanzas which receives and discharges across the St. Augustine Bar, 12 miles. The San Sebastian River, another lagoon, almost surrounds St. Augustine and opens into the Matanzas River about 3 miles from its mouth. These lagoons vary in depth from 20 to 30 feet for several miles from the mouth and in width 300 to 500 yards. They form large tidal basins, filled and emptied through the channels across the bar. The rise of tide at St. Augustine varies from 4 to 6 feet, and the currents generated have maintained two or more channels across the bar, with a least depth of from 6 to 9 feet at low water. The positions of these channels are continually shifting between the south end of the mainland east of the Tolomato River (North Beach or North Point) and the cape on Anastasia Island, 2¾ miles to the south. The harbor forms an excellent sheltered anchorage, but the shifting nature of the bar and the shallow water on its crest have presented so many difficulties to mariners that the commerce of the port has been greatly hampered.

Provision was made in the river and harbor act of 1886 for a survey of this harbor with a view to the formation of a deep channel on its outer bar. The estimate of the cost of the improvement submitted with the report of the survey was $1,500,000. The river and harbor act of 1888 appropriated $35,000 for the improvement of this harbor and directed that a Board of three Engineer Officers examine into the expediency of further improving the harbor upon the plans submitted. After a careful consideration of the subject and the plans presented, the Board appointed under this act did not deem it expedient at that time, for reasons set forth in its report, to enter upon a work of this magnitude in this locality. It therefore recommended that the amount appropriated, $35,000, be expended in the construction of jetties for the protection of the outer shores, near the entrance to the harbor, which were being eroded by the sea, this being a part of the plan proposed for obtaining deep water over the bar. This recommendation was approved and the work entered upon.

The following amounts have been appropriated for this work:

Act of—	
August 11, 1888	$35,000
September 19, 1890	20,000
July 13, 1892	10,000
Total	65,000

OPERATIONS PRIOR TO JUNE 30, 1893.

With the appropriation of $35,000, made in the act of 1888, three groins were built; No. 1, on Anastasia Island, near the northern boundary of the United States light-house reservation; No. 2, on North Beach, at the point; No. 3, on North Beach, about 2,000 feet from the point.

These groins all consist, essentially, of a foundation of brush fascines, covered with riprap and capped with concrete blocks which are 2 feet wide on top and have side slopes of 1 on 2. (For detailed description of dimensions and methods see Appendix P 3, Report of the Chief of Engineers, 1890.)

With the appropriation of $20,000 made in the act of September 19, 1890, groin No. 2 was extended seaward, and two new groins were built: No. 4, on Anastasia Island, about 2,200 feet northwest of groin No. 1; and No. 5, on North Beach, between groin No. 2 and groin No. 3. (For detailed description of demensions and methods see Appendix O 4, Report of the Chief of Engineers, 1891.)

The construction of a sheet-pile wing dam was begun in January and continued at intervals until May, 1892.

The act of July 13, 1892, appropriated $10,000 for the completion of the existing project. So many changes had taken place that it was decided to make a resurvey upon which to base the project for the expenditure of this appropriation. From the information thus obtained it was proposed to expend the amount available in constructing two new groins, located, one (No. 6) between No. 1 and No. 4, and one (No. 7) 1,700 feet east of No. 1. These two groins being deemed insufficient to complete the contemplated improvement, a revised estimate of cost was submitted on February 27, 1893. Changes in the sand shoal opposite Anastasia Island have caused the channel to impinge strongly on the island, producing considerable erosion. To secure the shore, two more groins, making nine in all, will be required, together with suitable wing walls on all the groins and beach revetments at a few places on the island. This additional work is estimated to cost $30,000, making the total cost (estimated) of the improvement $95,000.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

Groins Nos. 6 and 7, respectively 290 feet and 220 feet long, with suitable wing walls, were completed in October, 1893.

During the past fiscal year the locality has been visited by almost unprecedentedly severe storms, but the erosion of the shore due to them has been rapidly repaired by the action of the groins, and there is now good reason to believe that with the completion of the present project the shore lines may be considered as practically fixed in position.

St. Augustine is in the collection district of St. Augustine, which is the nearest port of entry. The nearest fort is Fort Marion. The St. Augustine Light is the nearest light-house.

Money statement.

July 1, 1893, balance unexpended	$8, 124. 97
June 30, 1894, amount expended during fiscal year	8, 042. 51
July 1, 1894, balance unexpended	82. 46
Amount (estimated) required for completion of existing project	30, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	10, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of harbor at St. Augustine, Fla., during the year ending December 31, 1893.

[Furnished by Mr. H. A. Barling, jr.]

Article.	Gross tonnage.	Estimated value.
Fertilizers	100	$3, 000
Fruits, oranges and grapes	400	10, 000
Grain	800	22, 000
Hay	1, 500	27, 500
Honey, sirup, etc	50	2, 500
Merchandise	17, 000	650, 000
Vegetables	200	8, 000
Fish and oysters	500	8, 500
Total	20, 550	731, 500

Estimated percentage of total trade of neighborhood carried by water, 5 per cent.
Probable increase of trade were the improvement completed, 35 per cent.

O 6.

IMPROVEMENT OF INDIAN RIVER, FLORIDA, BETWEEN GOAT CREEK AND JUPITER INLET.

The total length of this reach of the Indian River is 81 miles. Navigation was formerly interrupted by numerous shoals and bars having at low water a depth of from 2½ to 4 feet.

It was included in the franchise granted by the State of Florida to the Florida Coast Line Canal and Transportation Company, by which that company was authorized, in consideration of certain improvements to be made by it, to own vessels and navigate this waterway and t levy tolls upon its cuts and improved channels.

A survey and examination with estimate of the cost of the improvement of "Indian River between Titusville and Jupiter Inlet" was provided for in the river and harbor act of 1890.

The report made in compliance with this provision may be found i the Chief of Engineers' Report for 1891, p. 1673 *et seq.* The proje therein mentioned provides for making a continuous channel 5 feet dee at low water, and at least 75 feet wide in the straight reaches, with a much greater width in the turns as may be required, by widening th cuts of the canal company and making new cuts where needed, and b removing some of the mangroves in the narrows. It was estimate that the work proposed would cost, approximately, $44,000.

Prior to this time the Florida Coast Line Canal and Transportati Company, under its charter from the State, dredged a number (23 o cuts across shoals within this reach, making a continuous navigabl channel 50 feet wide and 5 feet deep. The aggregate length of thes cuts is 39,500 feet.

By act approved July 13, 1892, $15,000 were appropriated for—

> Improving Indian River, Florida, between Goat Creek and Jupiter Inlet: *Provided*, That no part of the money appropriated shall be expended until the Flori Coast Line Canal and Transportation Company surrenders and relinquishes to th United States all the rights and privileges which it now holds under State chart along the entire route.

There has been considerable delay in obtaining the requisite relinquishments from the company required by the provisions of this ac The matter is now settled, and the relinquishments have been made i due form to the satisfaction of the United States Attorney General.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1894.

On the first of June some necessary repairs were commenced up the United States snag and dredge boat *Suwanee*, lying in ordinary a Tampa, Fla., preparatory to taking her around to Indian River for th purpose of dredging, in accordance with the approved project. Thes repairs were practically completed at the end of the month. The boat will enter the river and commence operations early in July.

It is estimated that $15,000 can be profitably expended during th fiscal year ending June 30, 1896, in carrying out this project.

Indian River is in the collection district of St. Augustine, Fla., which is the nearest port of entry. Nearest lighthouses are Jupiter Light and Canaveral Lig Nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1893, balance unexpended	$15,000.
June 30, 1894, amount expended during fiscal year	1,169.
July 1, 1894, balance unexpended	13,830.
July 1, 1894, outstanding liabilities	1,077.
July 1, 1894, balance available	12,752.
Amount (estimated) required for completion of existing project	29,000.
Amount that can be profitably expended in fiscal year ending June 30, 1896	15,000.

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of Indian River, Florida, during the year ending December 31, 1893.

[Furnished by the Jacksonville, St. Augustine and Indian River and Jacksonville, Tampa and Key West railways.]

Names of article.	Gross tonnage.	Estimated value.
Coal	1,448	$8.688
Cattle	410	16,400
Fertilizers	4,832	120,800
Fruits, assorted	48	3,380
Grain and hay	5,074	101,480
Dressed meat	255	51,000
Lumber, rough	23,782	237,820
Lumber, dressed	5,628	84,420
Merchandise	34,283	3,428.300
Oranges	10,457	522,850
Pineapples	2,365	118.250
Phosphate; rock and pebble	1,798	17,980
Vegetables	876	34,040
Fish and oysters	523	110,000
Railroad supplies	33,768	675,300
Lime, brick, and cement	5,430	81,450
Total	130,977	5,612,218

Estimated number of passengers carried by water, 75,000; estimated percentage of total trade of neighborhood carried by water, 50 per cent; probable increase of trade were the improvement completed, 25 per cent.

EXAMINATION OF NEGRO CUT AND VICINITY, INDIAN RIVER, FLORIDA.

[Printed in Senate Ex. Doc. No. 3, Fifty-third Congress, second session.]

WAR DEPARTMENT,
Washington, D. C., December 5, 1893.

SIR: Responding to Senate resolution of October 17, 1893 (calendar day October 26), directing the Secretary of War to communicate to the Senate the cost of dredging a channel from the channel of the Indian River, of Florida, through the Negro Cut, to the bar at the Indian River Inlet, of the depth of 6 feet, I have the honor to transmit herewith a letter of the Chief of Enginners, of the 4th instant, forwarding the report of Lieut. A. M. D'Armit, Corps of Engineers, of the examination of Negro Cut and vicinity, at Indian River Inlet. The Chief of Engineers estimates that it will cost $32,775 to make a channel 100 feet wide and 6 feet deep.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The PRESIDENT OF THE UNITED STATES SENATE.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 4, 1893.

SIR: I have the honor to submit the accompanying report, dated the 1st instant, from Lieut. A. M. D'Armit, Corps of Engineers, on an examination of Negro Cut and its vicinity, at Indian River Inlet, Florida.

This report is made in response to a resolution of the United States Senate, dated October 17, 1893, as follows:

Resolved, That the Secretary of War be directed to communicate to the Senate from information in his possession, or which he may acquire, the cost of dredging a channel from the channel of the Indian River, of Florida, through the Negro Cut, to the bar at the Indian River Inlet, of the depth of 6 feet.

It is estimated that it will cost $32,775 to make a channel 100 feet wide and 6 feet deep.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. DANIEL S. LAMONT,
Secretary of War.

REPORT OF LIEUT. A. M. D'ARMIT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., December 1, 1893.

GENERAL: I have the honor to submit the following report, in compliance with Department letter of November 2, 1893, calling for "an examination upon which to base an estimate of the cost of dredging a channel 6 feet in depth from the channel of Indian River, through Negro Cut, to the bar at the Indian River Inlet."

An examination was made by Mr. J. W. Sackett, assistant engineer, to whose report, inclosed herewith, I respectfully invite attention. Mr. Sackett's estimates are as follows, and meet my entire approval:

For channel 100 feet wide and 6 feet deep:	
60,000 cubic yards dredging, at 35 cents per cubic yard	$21,000
3,000 linear feet training wall, at $2.50 per foot	7,500
Engineering and contingencies, 15 per cent	4,275
Total	32,775
For channel 100 feet wide and 5 feet deep:	
42,000 cubic yards dredging, at 35 cents per cubic yard	14,700
2,000 linear feet training wall, at $2.50 per foot	5,000
Engineering and contingencies, 15 per cent	2,955
Total	22,655

A visit to the Indian River develops the following facts in relation to the project: As stated in Mr. Sackett's report, the Indian River Inlet is the most important inlet to the Indian River when permanency is taken into consideration. Just at present Santa Lucia Inlet, 20 miles farther south, presents more favorable conditions, but it is questionable whether they will be maintained. If they are, any improvement of Negro Cut will be unnecessary. The depth of water at Santa Lucia is so much greater than is obtainable at Negro Cut, that it would seem to merit an examination before proceeding to the improvement of Negro Cut. This latter improvement should only be undertaken in connection with a comprehensive scheme for the improvement of Indian River as a whole, as contemplated in the act appropriating $15,000 for such purpose. When the work under this appropriation is being done the improvement of Negro Cut can be more easily and cheaply accomplished, and the relative merits of entrances at Santa Lucia and Indian River inlets definitely determined.

In conclusion, I would respectfully invite especial attention to Mr. Sackett's recommendation of a 5-foot channel, which, in my opinion, is as great a depth as is needed.

Very respectfully, your obedient servant,

A. M. D'ARMIT,
Second Lieut., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF MR. J. W. SACKETT, ASSISTANT ENGINEERR.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., December 1, 1893.

SIR: I have the honor to submit the following report of an examination of Negro Cut and its vicinity at Indian River Inlet, Florida, made in pursuance of your instructions:

Indian River Inlet is the most important entrance into the river of that name, a description of which appears in Appendix O 16, Report of the Chief of Engineers, 1891, to which I would respectfully invite attention.

The inlet proper is a breach in the narrow strip of sandy and mostly barren land separating the Indian River from the Atlantic Ocean. Its location is subject to variations through a range of three-quarters of a mile north and south, but it is believed to be more permanent in its present location than elsewhere.

The waterway immediately inside the entrance is obstructed by numerous islands and sand shoals. There are three well-defined channels leading into the river from the inlet. The largest one is Negro Cut, and it leads directly into the river from the present location of the inlet. Blue Hole Cut leads into the river to the north of the inlet through a narrow and tortuous but fairly deep channel, and Fort Pierce Cut reaches the river to the south. Each of these cuts is subdivided into two or more channels before reaching the river.

As instructed, I examined the channel across the bar outside the inlet and the main channel of the river proper with a view of ascertaining the present depth of water available for navigation. On the bar I found a practicable channel with a least depth of 6 feet at mean low water. A depth of 6 feet also exists in the main channel of the river opposite the inlet, but this depth does not extend throughout the entire length of the river, there being shoal places at Indian River Narrows and Grants Farm to the northward, and Jupiter Narrows and Jupiter Sound toward the south, with other shoal places here and there along the river with only 5 feet over them. The project for the improvement of Indian River between Goat Creek and Jupiter Inlet contemplates the extension of the cuts made through the shoal places by the Florida Coast Line Canal and Transportation Company with a view of obtaining a channel 75 feet wide and 5 feet deep at low water.

The present channel through Negro Cut has a depth in excess of 6 feet as far as it is confined between the Mangrove Islands, with the exception of one place where it expands to a width of over 1,000 feet. Even through this place a narrow and crooked channel exists having not less than 5 feet. After leaving the Mangrove Islands the channel enters the broad expanse of the river where it begins to shoal until on the bar in the river a depth of only 2¼ feet exists.

The defective portions of the channel through Negro Cut were carefully sounded, and enough borings were taken to determine the character of the material. The plane of reference was the mean of low-water readings on a gauge located in the cut on the south side about 700 feet from the river entrance. The observations covered a period of six days and it is believed that the conditions were normal. The mean range on this gauge was 0.75 foot. At the inlet the mean range is probably about 2 feet, while in the river, when the level of the water is not affected by the winds, the mean range is probably less than 0.3 foot.

From this data the following estimates have been prepared:

For channel 100 feet wide and 6 feet deep:	
60,000 cubic yards dredging, at 35 cents per cubic yard	$21,000
3,000 linear feet training wall, at $2.50 per foot	7,500
Engineering and contingencies, 15 per cent	4,275
Total	32,775

For channel 100 feet wide and 5 feet deep:

42,000 cubic yards dredging, at 35 cents per cubic yard	$14,700
2,000 linear feet training wall, at $2.50 per foot	5,000
Engineering and contingencies, 15 per cent	2,955
Total	22,655

These quantities are computed for 1 foot extra depth to allow for back filling. To insure permanency in the dredged channel through the shoal in the river, it is believed that a training wall will be required. This can be constructed of palmetto piles in juxtaposition, protected on each side with fascines of mangrove brush, over which the dredged material should be discharged.

It is believed that a channel 5 feet deep will answer the requirements of commerce, and it is respectfully recommended.

Very respectfully, your obedient servant,

J. W. SACKETT,
Assistant Engineer.

Lieut. A. M. D'ARMIT,
Corps of Engineers, U. S. A.

O 7.

IMPROVEMENT OF NORTHWEST ENTRANCE, KEY WEST HARBOR, FLORIDA.

The Florida Keys consist of a chain of rock and sand islands extending southwesterly from Cape Florida for nearly 200 miles. They are connected by extensive sand flats underlaid by rock, a soft oolitic limestone, from which the sand is almost entirely formed.

This chain is a barrier for all shipping from the Atlantic to the gulf (eastern and middle) ports, and the straits between it and the West India Islands form a passage justly dreaded by mariners. This barrier is crossed by four navigable channels—one between the Dry Tortugas, at the western extremity of the chain, and Rebecca Shoals; one east of Rebecca Shoals; the third (the Boca Grande Channel) 28 miles farther east, and the fourth (the northwest channel from Key West Harbor) immediately west of Key West, 85 miles east from the Dry Tortugas. It is this eastern position, combined with the good harbor of Key West at its extremity, which gives this channel its importance. It is used by vessels en route between the Atlantic and gulf ports which do not draw more than 10.5 feet of water, the depth now available on the bar which obstructs its northern end. In rough weather the available depth is still more reduced, and vessels of more than 8 feet draft are compelled to pass through one of the channels to the westward.

PROJECT OF IMPROVEMENT.

To begin improvement with a long jetty on the northeastern side, probably supplemented as the work progresses by a jetty on the western side. (See Appendix P 4, Annual Report of the Chief of Engineers for 1890.) The estimated cost of the first jetty is $500,000.

WORK DONE AND RESULTS OBTAINED.

The following appropriations have been made for this work:

Act of—	
September 19, 1890	$40,000
July 13, 1892	75,000
Total	115,000

Under the first appropriation 27,982.2 cubic yards of stone were deposited in place, making a jetty 6,888 feet long with a width at the base of 25 feet and a crest width of 10 feet. The depth over the jetty varied from 2 feet to 10 feet at low water. As a result of this work a channel having 12.5 feet of water at low water was formed and seemed to be permanent although rather tortuous.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

Under the second appropriation of $75,000 a contract was entered into with Mr. R. G. Ross, of Jacksonville, Fla., for furnishing stone in place for $2.58 per cubic yard, and $2.40 per cubic yard for quarry chips. Work was begun in June, 1893, and up to the end of the past fiscal year 2,969 cubic yards of stone has been placed in the jetty. This contract was completed November 30, 1893. A total of 22,434.7 cubic yards of stone and 1,397.8 cubic yards of quarry chips were placed under this contract, making the jetty 11,364 feet long.

The stone used in this work has all been the soft limestone quarried from the keys of the locality and is so light that it will not stand above from 4 to 5 feet below low water. The jetty having been extended to its full length a portion of the rock was used in widening the base to 50 feet over a part of its length instead of building any higher. Heavier rock than can be obtained in this vicinity or concrete blocks will be needed to carry the jetty to its full height. The use of the small quarry chips has proven very satisfactory. The small pieces sink into the spaces left by the larger stones, making a very compact jetty. This action is very clearly seen in the clear water of the gulf. Very little shell growth has been observed. No sinking of the jetty has occurred even where stone has been deposited on a layer of sand overlying the natural rock bottom.

As a result of the jetty, during the early part of the present calendar year a new channel has been formed, which was tried by the steamers of the Plant Steamship Company and found to have better water and to be straighter than the former sailing channel. Accordingly, at the request of this office, the new channel was buoyed by the Light-House Department, and is in constant use by all vessels. Its least depth is 12 feet at mean low water, and there is but one turn in the channel. This channel being precisely where desired, its permanency is greatly to be desired, and this result, together with a further deepening, will perhaps be best secured by raising the present jetty to its full height with heavy rock as soon as funds shall become available. If, however, the channel should continue to move to the westward, as it undoubtedly shows a tendency to do, the immediate construction of the west jetty may be demanded.

Under date of September 24, 1892, authority was given for the removal of the Pinnacle Rocks, forming an obstruction in the main ship channel, at a cost of $1,000. An agreement was entered into with Mr. Bradish W. Johnson, under date of October 20, 1892, to remove the obstruction for $800.

Mr. Johnson having failed to do the work, the agreement was annulled in July, 1893, and in August the rock was removed by hired labor by blasting with dynamite. All rock was removed to below 30 feet at mean low water.

Much credit is due to Mr. A. C. Harper, superintendent in local charge of all work at Key West, for his efficient management of the many details and complications arising at this isolated station.

The harbor at Key West is in the collection district of Key West, Fla., which is the nearest port of entry. Nearest light-house is the Northwest Passage Light. Nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1893, balance unexpended	$67,840.85
June 30, 1894, amount expended during fiscal year	67,444.82
July 1, 1894, balance unexpended	396.03
Amount (estimated) required for completion of existing project	385,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	385,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of harbor at Key West, Fla., during the year ending December 31, 1893.

[Furnished by J. B. Browne, collector of customs.]

Articles.	Gross tonnage.	Estimated value.
Cattle	2,040	$150,000
Fruits	6,500	130,000
Grain	4,000	135,000
Hides	135	11,250
Honey, sirup, etc	100	20,000
Lumber, rough	6,000	60,000
Lumber, dressed	2,000	25,000
Merchandise	45,000	4,500,000
Oranges	12	5,000
Pineapples	14,000	300,000
Ship stores	1,000	100,000
Vegetables	15,000	150,000
Fish, fresh and salt	300	60,000
Sponges	100	400,000
Tobacco	937	1,000,000
Cigars	750	7,000,000
Wines and liquors	500	150,000
Total	101,274	14,196,250

Remarks.—Key West has been affected by the general depression of business which prevailed throughout the country during a part of the year 1893, which caused a falling off of 25 per cent in its commercial statistics.

Arrivals and departures of vessels for the year ending December 31, 1893.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	475	712,500	475	712,500
Sailing vessels	100	60,000	100	60,000
Yachts	25	2,500	25	2,500
Total	600	775,000	600	775,000

Estimated number of passengers carried by water, 30,000. Estimated percentage of total trade of neighborhood carried by water, 100 per cent.

Average draft of steamers, 11½ feet; average draft of sailing vessels, 6 feet.

O 8.

IMPROVEMENT OF CALOOSAHATCHEE RIVER, FLORIDA.

The Caloosahatchee River rises in the saw-grass region west of Lake Okeechobee and flows west into San Carlos Bay. Between the mouth and Fort Thompson, 22 miles west of Lake Okeechobee, the river banks are generally high and the country bordering the river is covered with a dense growth of large trees, principally pines, palmettos, and oaks. East of Fort Thompson the low saw-grass region begins. The entire river valley as far as Alva, about 20 miles by river below Fort Thompson, is more or less subject to overflow by the water coming from the Okeechobee Basin. For 21 miles from its mouth the river is broad and has a channel depth of from 6 to 20 feet, with the characteristics of an estuary. This portion of the river is obstructed by oyster bars. Great beds of snags obstruct the upper river. From Alva down the country is being settled for the culture of sugar cane, pineapples, cocoanuts, oranges, limes, and lemons. Fine cattle ranges exist along the upper river.

Fort Myers, a depot for supplies during the Seminole war, is a thriving town, 17 miles from the mouth.

Under the laws of the State of Florida the Atlantic and Gulf Coast Canal and Okeechobee Land Company is engaged in draining the Okeechobee Basin, having authority from the State to cut canals and use the natural waterways for that purpose. A canal with a minimum cross section of 22 feet by 5 feet has been opened from Lake Okeechobee to the headwaters of the Caloosahatchee River, and through them as far as the western end of Lake Flirt. A rocky ledge at Fort Thompson has been removed and four cut-offs have been made across the worst bends below Fort Thompson. These works were not intended for the benefit of navigation, but they have incidentally opened a water route about 300 miles long from the Gulf of Mexico to the interior of Florida, via San Carlos Bay, the Caloosahatchee River, and Lake Okeechobee, the Kissimmee River, and lakes Kissimmee, Cypress, and Tohopekaliga. Steamers now pass over the route at irregular intervals.

An examination of the river with a view to its improvement was made in March and April, 1879. A report thereon, dated August 27, 1879, with a plan of improvement, is printed as Appendix J 17, Report of the Chief of Engineers for 1879.

The project, adopted in 1882, called for deepening the channel by dredging from Fort Myers, so as to give a depth of 7 feet at mean low water for a width of 100 feet. In 1886 and 1888 this project was modified so as to include the improvement of the upper river as far as Fort Thompson by the removal of snags and overhanging trees and by deepening the channel near Beautiful Islands.

The following appropriations have been made for this improvement:

Act of—	
1882	$5,000
1884	5,000
1886	4,000
1888	10,000
1890	3,600
1892	1,000
Total	28,600

OPERATIONS PRIOR TO JUNE 30, 1893.

In 1885 the 7-foot channel through the lower river was reported completed. In 1886-'87 the operations were confined to clearing snags and overhanging trees from the river between forts Denaud and Thompson and in making an instrumental survey of the entire river. This survey showed the existence of a practicable channel 6 feet deep and at least 100 feet wide from the mouth to Fort Myers. It also showed that, excepting near the Beautiful Islands, the channel has sufficient depth and width to permit boats of 4 feet draft to ascend the river as high as Fort Thompson. The upper river was, however, badly obstructed by snags and overhanging trees; only a short reach, 4½ miles long, having been cleared by the work during May and June, 1887.

Before improvement the lower part of the river was so obstructed by oyster bars that the available channel depth was only about 5¼ feet. About 17 miles from the mouth the river loses the characteristics of an estuary, and there are numerous islands and a broad shoal. At the present time the river has been improved so that a navigable channel depth of about 6 feet exists between the mouth and Fort Myers, and between Fort Myers and Fort Thompson it is 4 feet.

A dike or training wall alongside the cut through Beautiful Island Shoals has been built. It consists of a row of piles in juxtaposition, driven to hard bottom, with a light waling strip on each side. A layer of brush 4 feet wide is placed at the foot of the piles and held down by stakes and a layer of shell and stone. Upon this was deposited the material dredged from the cut. The channels through the oyster bars have been marked with stakes. For details of the work see Annual Report of the Chief of Engineers for 1891, pp. 1644 and 1645.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

The $1,000 appropriated in 1892 was expended in clearing the upper river and marking the channel in the lower river. The work was done by the U. S. steam snag and dredge boat *Suwanee*. Work was begun October 10 and ended October 30, 1893. For details attention is invited to the report of Mr. Otto Bie, captain of the *Suwanee*, in local charge of the work.

The river is now in excellent condition, and, with the annual appropriation of $1,000 asked for, can be easily kept clear.

Caloosahatchee River is in the collection district of Key West, which is the nearest port of entry; nearest light-house is Sanibel Island Light, and nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1893, balance unexpended	$1,009.[illegible]
June 30, 1894, amount expended during fiscal year	1,002.[illegible]
July 1, 1894, balance unexpended	7.[illegible]
Amount (estimated) required for maintenance of existing project	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. OTTO BIE, SUPERINTENDENT, ON OPERATIONS DURING THE YEAR.

CEDAR KEYS, FLA., *November 15, 1893.*

LIEUTENANT: I have the honor to report the following in regard to work done on the Caloosahatchee River.

The U. S. snag boat *Suwanee*, after completing the work on the Manatee River, left Tampa October 9, arrived on the Caloosahatchee River the following day, and proceeded up the river to remove obstructions to navigation.

Fifty-seven large snags and 16 overhanging trees were removed between Stations 46 and 58 (numbers of stations are distances in miles from Punta Rassa).

After completing this, the *Suwanee* returned to the lower river to stake out the channel from Redfish Point to the lower oyster bars. Nineteen palmetto piles, driven about 15 feet high above mean low water and about 7½ feet in the bank, with targets 2½ by 4 feet, were established. The available money for the Caloosahatchee River being then nearly exhausted, the *Suwanee* left for Cedar Keys October 30.

A crooked but well-defined channel with minimum depth of 6.5 feet at mean low water exists between Punta Rassa and Myers.

The Beautiful Island training wall and cut made by the *Suwanee* in 1890 are in good condition; the shallowest place in the cut is at its lower end, the minimum depth there being 3.8 feet.

From Beautiful Island to Fort Thompson the channel along the middle of the river is at present entirely free from snags.

The steep banks of the river from Alva to within 2 miles of Fort Thompson (a distance of 18 miles) are lined with overhanging trees, and every year during the rainy season the caving in of the banks causes trees to fall into the river; in narrow bends fallen trees are sometimes found completely blockading the river.

Great satisfaction prevails amongst the settlers in the Caloosahatchee Valley regarding the work done by the *Suwanee* in 1890. Previous to that time the river overflowed its banks nearly every year, and settlements have been inundated for weeks at a time. Since 1890 no overflow has occurred; the river, after heavy local rains, has sometimes risen to the top of its banks, but only for a few hours has it retained this height. Settlements which had been abandoned are now under cultivation again.

This change for the better may be ascribed to the conditions of the river then and now. Where in 1890, before snagging was done, sand bars, with only 1 or 2 feet depth, had formed on top of large clusters of snags, there is now, the snags being removed, from 5 to 6 feet depth.

The steamer *H. O'Neill* makes weekly trips between Myers and the upper river, and a comparatively large stern-wheel steamer, "*City of Athens*," is now being rebuilt to run semiweekly between Fort Myers and Fort Thompson.

In the summer a triweekly and in the winter a daily line of steamers run between Myers and Punta Gorda.

Very respectfully, your obedient servant,

OTTO BIE,
Superintendent.

Lieut. A. M. D'ARMIT,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Commerce of Caloosahatchee River, Florida, during the year ending December 31, 1893.

[Furnished by Capt. William H. Towles.]

Articles.	Gross tonnage.	Estimated value.
Cattle	1,750	$84,000
Fertilizers	100	4,000
Grain	45	9,000
Hides	50	6,000
Honey, sirup, etc	35	3,500
Lumber, rough and dressed	2,000	20,000
Merchandise	500	100,000
Oranges	105	5,250
Vegetables	55	2,750
Total	4,640	234,500

Vessels.

	Number.	Tonnage.	[illegible] trips.
Steamers	5	250	[illegible]
Sailing vessels	2	75	[illegible]
Yachts	50	500	......

Estimated number of passengers carried by water, 1,700.

Estimated percentage of total trade of neighborhood carried by water, 100 per cent. Probable increase of trade were the improvement completed, 50 per cent.

O 9.

IMPROVEMENT OF CHARLOTTE HARBOR AND PEASE CREEK, FLORIDA.

The river and harbor act approved September 19, 1890, contained an item for "improving, dredging, and deepening the channel of Charlotte Harbor and Pease Creek, Florida, to the pier at Punta Gorda, the terminus of the Florida Southern Railroad, thirty-five thousand dollars."

Under this appropriation a survey of the deep water of the harbor was made from Boca Grande Pass to Punta Gorda. There was found at that time a channel depth of 19 feet at mean low water on the bar at the pass, 9 feet upon the shoals south of Cape Haze, and 10 feet upon the shoal near the wharves at Punta Gorda. The rise of tide is about 2 feet. An estimate was made for dredging a channel 300 feet wide and 23 feet deep through the bar at Boca Grande Pass. The amount of this was $35,000. A separate estimate was made for forming a channel 200 feet wide and 12 feet deep from the wharves at Punta Gorda to the pass. The amount of this was $127,500. The report upon this survey and description of the harbor may be found in the Chief of Engineer's Report for 1891, p. 1646 *et seq.*

Work was inaugurated under the project for the 12-foot channel, estimated to cost $127,500, and the funds expended in dredging the channel near Punta Gorda wharves. The work thus far accomplished has resulted in forming a channel 300 feet wide for a distance of 300 feet in front of the wharves, 160 feet wide for a distance of 4,729 feet, and 120 feet wide for a distance of 1,764 feet, where it connects with the 12-foot contours. The total length of the dredged cut is 6,793 feet. Over nearly the whole of this length the depth is in excess of 13 feet.

By reason of the nearly exhausted condition of the appropriation for this work, no dredging was done during the fiscal year ending June 30, 1894.

A survey of the shoal north of Cape Haze was made in May for the purpose of determining the best location in which to develop the 12-foot channel over these shoals when additional funds are made available for the work.

It is estimated that $35,000 can be profitably expended upon this work during the fiscal year ending June 30, 1896.

Charlotte Harbor is in the collection district of Key West, and Punta Gorda is the nearest port of entry; nearest light-house is Gasparilla Light, and the nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1893, balance unexpended	$11,503.69
June 30, 1894, amount expended during fiscal year	11,154.39
July 1, 1894, balance unexpended	349.30
Amount (estimated) required for completion of existing project	92,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	35,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of Charlotte Harbor, Florida, during the year ending December 31, 1893.

[Furnished by Mr. Albert W. Gilchrist, of Punta Gorda.]

Articles.	Gross tonnage.	Estimated value.
Cattle	333	$12,000
Fruits	400	4,000
Grain	1,294	32,362
Lumber, rough	110	3,300
Lumber, dressed	200	6,000
Merchandise	2,321	122,421
Oranges	4,000	60,000
Phosphate, pebble	88,467	884,670
Total	97,125	1,124,753

Arrivals and departures of vessels for the year ending December 31, 1893.

Kind of vessel.	Arrivals.		Departures.	
	No.	*Tons.*	*No.*	*Tons.*
Steamers	59	60,591	59	60,591
Sailing vessels	43	13,490	43	13,490
Yachts	20	140	20	140
Total	122	74,121	122	74,121

Estimated percentage of total trade of neighborhood carried by water, 50 per cent. Probable increase of trade were the improvement completed, 150 per cent.

O 10.

IMPROVEMENT OF SARASOTA BAY, FLORIDA.

An examination and survey of the bay was made in 1889. The report thereon, with the project for improvement, is printed on p. 1617, Vol. II, of the Report of the Chief of Engineers for 1890. An appropriation of $5,000 was made in the act approved September 19, 1890, for "improving Sarasota Bay from Tampa Bay to Sarasota, Fla."

A navigable channel, with a minimum depth of 5 feet, extends throughout the length of Big Sarasota Bay, excepting in two reaches, Palma Sola Pass and Long Bar, which have a total length of 5,400 feet. In these reaches the available depth was 4.3 and 3.5 feet, respectively. The tidal range in the bay is 1.5 feet.

The present approved project calls for the formation of a continuous channel, 100 feet wide and 5 feet deep at mean low water, from Tampa Bay to the town of Sarasota, Fla., a distance of 21¼ miles, at an estimated cost of $17,500.

The following amounts have been appropriated for this work:

By act of—	
September 19, 1890	$5,00
July 13, 1892	2,50
Total	7,50

With these amounts dredging has been done upon the Palma Sola Shoal which has resulted in connecting the 5-foot contours by a cut 2,292 feet long, of which a length of 1,673 feet is 38 feet wide with a depth of 6 feet, while for the remaining 619 feet the cut is 40 feet wide and from 5 to 6 feet deep. A total amount of 6,456.5 cubic yards of sand and shell, measured in place, has been removed. The last examination shows that this cut has not filled in.

Sarasota Bay is in the collection district of Tampa, which is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fort is Fort Taylor.

Money statement.

July 1, 1893, balance unexpended	$577.38
June 30, 1894, amount expended during fiscal year	525.21
July 1, 1894, balance unexpended	52.17

COMMERCIAL STATISTICS.

Commerce of Sarasota Bay, Florida, for the year ending December 31, 1893.

[Furnished by Mr. J. H. Gillespie.]

Articles.	Gross tonnage.	Estimated value.
Cattle	250	$10,00
Fertilizers	20	80
Fruits	25	1,00
Grain	20	60
Hides	3	30
Honey, sirup, etc	20	2,00
Lumber, rough and dressed	200	10,48
Merchandise	100	18,00
Oranges	400	16,00
Vegetables	63	5,00
Total	1,101	57,10

Estimated number of passengers carried by water—no lists kept.

Estimated percentage of total trade of neighborhood carried by water, 75 per cent. Probable increase of trade were the improvement completed, 200 per cent.

O 11.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

Manatee River rises in the southern part of Florida and flows in a westerly direction, emptying into Tampa Bay on its southern shore. For a distance of 12 miles from its mouth it has the characteristics of an estuary. For 10 miles the settlements along its banks are almost continuous. They comprise the towns of Manatee, Hendrix, Ellenton, Palmetto, Braidentown, and Palma Sola. Oranges and vegetables are raised in large quantities. From the fine ranges along the upper river hides, wool, and sheepskins are exported. Phosphate deposits have been discovered along the river and mining operations are being carried on.

Before improvement in the estuary the general depth of the river varied from 7 to 20 feet. At the mouth there was a long shoal with a depth of 7 feet. Between Palmetto and Braidentown there was another bar covered by from 3 to 5 feet of water.

An examination of Manatee River with a view to its improvement was made in 1881. A report thereon, dated February 16, 1882, with plan of improvement is printed as part of Appendix K 25, Annual Report of the Chief of Engineers for 1882.

PROJECT OF IMPROVEMENT.

To form a channel 100 feet wide and 13 feet deep from Tampa Bay to Shaw and McNeil points, at an estimated cost of $70,000. This project was changed in 1887 with a view to obtaining a channel 100 feet wide and 8 feet deep from Tampa Bay to Manatee. The reasons for this change, together with a map of the river, will be found on p. 1109, Annual Report of the Chief of Engineers for 1888. The revised estimate was $73,000.

WORK DONE AND RESULTS OBTAINED.

The following appropriations have been made for this work:

Act of—	
August 2, 1882	$12,000
August 5, 1886	11,000
August 11, 1888	5,000
September 19, 1890	6,000
July 13, 1892	6,000
Total	40,000

In 1890 the modified project was completed. The appropriation of $6,000, made September 19, 1890, was not considered sufficient to permit the extension of the project, and was held until the appropriation of July 13, 1892, made the sum available $12,000.

An examination made in June, 1892, showed that the cuts made during and prior to 1890 had been well maintained and that a clear channel 100 feet wide and from 8 to 9 feet deep existed over the entire length. At the same time an examination was made of the outer bar and of the bulkhead lying in the mouth of the river between Snead and Shaws points. It was found that an available channel depth of more than 9 feet already existed on the outer bar, and that a cut through the bulkhead above referred to could be so located that advantage could be taken of the direction of the currents, so that its permanence would be reasonably assured. The steamboat men were very anxious to have this cut made, as it would materially shorten and straighten the channel and avoid the necessity of crossing a long stretch of water having a depth of only 8 feet. In view of these facts, it was decided to adhere to the original project of 1882, confining operations for the present to making a cut 100 feet wide and 12 feet deep at mean low water through the bulkhead at Snead Point. A cut at this point was adopted because of the immediate advantage it would give the trade of the river as far as Palmetto, a distance of 7 miles, whereas the sum available was not sufficient to begin work upon the outer bar. The projected cut is estimated to require the excavation of 36,400 cubic yards of material (in place) and the work was done by the dredge boat *Suwanee*. Work was begun in June, 1893.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

The work of dredging was completed in September, 1893.

Dredging between Palma Sola and the entrance to the Manatee River was continued by the U. S. snag and dredge boat *Suwanee*. A total of 22,300.4 cubic yards of material, consisting of sand and broken shells, has been removed, and this has resulted in forming a channel entirely through the bulkhead between the 12-foot contours on each side, 81 feet wide and from 12 to 13 feet deep at mean low water.

The work of the dredge boat, which was fitted with new machinery especially for this work, has been very satisfactory. The dredging pump has a 10-inch suction and discharge, and on this work discharged through from 146 to 176 feet of 11-inch discharge pipe, supported on pontons.

The site of the work is an exposed one and considerable delay was occasioned by storms. During the month of September, 1893, the dredge maintained an average of over 80 cubic yards per hour of actual pumping, and on one day (September 13) 1,021 cubic yards of material were removed. The average cost per cubic yard of sand in place, including rather extensive and unusual repairs to plant, was but 19.3 cents, a saving of at least 15 cents per yard in this locality.

Manatee River is in the collection district of Tampa. Tampa is the nearest port of entry. Nearest light-house is Egmont Key Light; nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1893, balance unexpended	$4,447.29
June 30, 1894, amount expended during fiscal year	4,390.66
July 1, 1894, balance unexpended	56.63
Amount (estimated) required for completion of existing project	33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Commerce of Manatee River, Florida, during the year ending December 31, 1893.

[Furnished by Capt J. W. Fitzgerald, superintendent Plant Steamship Line.]

Articles.	Gross tonnage.	Estimated value.
Grain	1,500	$37,500
Hides	50	5,000
Merchandise	2,352	588,000
Oranges	2,422	[illegible]
Vegetables	548	[illegible]
Total	6,872	744,254

Steamers arrived, 313; tons, 78,200; departures, 313; tons, 78,200.

Actual number of passengers carried by water, 10,808.

Estimated percentage of total trade of neighborhood carried by water, 90 per cent. Probable increase of trade were the improvement completed, 50 per cent.

O 12.

IMPROVEMENT OF TAMPA BAY, FLORIDA.

An examination of Tampa Bay, with a view to its improvement, was made in 1879. A report thereon, dated August 25, 1879, with a project for improvement, is printed in Appendix J 18, Report of the Chief of Engineers, 1879.

A navigable depth of 7 feet at low water at that time prevailed from Tampa to the bay, and from there to the gulf 12 feet only could be carried. The approved project at that time adopted was to deepen and widen the channel from Tampa to the bay, a distance of 5¾ miles, by dredging and rock excavation, so as to give a clear depth of 9 feet at mean low water, with a width in the river of 200 feet and in the bay of 150 feet. The estimated cost of this improvement was $97,000.

In 1888 this project was modified so as to provide for a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 200 feet wide and 20 feet deep at mean low water from the gulf to Port Tampa, a town situated near the mouth of Old Tampa Bay, and about 9¼ miles from Tampa. It was estimated at that time that the completion of the project as modified would cost $35,000.

The following appropriations have been made for this improvement:

Act of—	
June 14, 1880	$10,000
March 3, 1881	10,000
August 2, 1882	20,000
July 5, 1884	20,000
August 5, 1886	10,000
August 11, 1888	25,000
September 19, 1890	25,000
July 13, 1892	10,000
Total	130,000

These appropriations have provided all the funds required by the original and modified projects.

WORK DONE AND RESULTS OBTAINED.

The Port Tampa Channel was completed March 28, 1891, at which time its condition was as follows:

The cut at the entrance had a mean low-water depth of 20 feet, with a width of 115 feet for one-half its length and of 100 feet for the remaining distance, with an additional width of 75 feet the entire length, having a mean low-water depth of 16 feet. The upper cut was 150 feet wide, with a mid-channel depth of 19.7 feet. The tidal range is 1.5 feet. Since that date no apparent change has taken place in the channel.

Work in the Hillsboro Bay Channel was stopped June 3, 1893, at which time the channel was 200 feet wide in the mouth of the Hillsboro River, and from 75 to 100 feet wide in the bay, with a depth of from 8 to 9 feet throughout. This condition is unchanged.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

There were no operations during the past fiscal year. The cuts retain their depths and widths.

Tampa Bay is the collection district of Tampa, which is the nearest port of entry. Nearest light-house is Egmont Key light. Nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1893, balance unexpended	$3,225.3
June 30, 1894, amount expended during fiscal year	3,225.
July 1, 1894, balance unexpended	1.8

COMMERCIAL STATISTICS.

Commerce of Tampa Bay, Florida, during the year ending December 31, 1893.

[Furnished by Capt. J. W. Fitzgerald, superintendent Plant Steamship Line, and Capt. Otto Bie, U. S. steam snag boat *Suwanee*.]

Articles.	Gross tonnage.	Estimated value.
Fruits	500	$10,6
Grain	10,000	25,0
Hides	50	6,
Lumber, rough	15,000	90,0
Lumber, dressed	10,000	100,0
Merchandise	30,000	7,500,
Oranges	3,422	128,35
Pine apples	650	26,0
Phosphate, rock	45,867	266,9
Phosphate, pebble	62,770	376,42
Ship stores	1,000	250,0
Vegetables	1,100	44,0
Fish and oysters	2,084	81,34
Railroad supplies	....	1,800,0
Tobacco and cigars	900	4,500,0
Hay	5,000	100,0
Total	188,343	15,631,2

Arrivals and departures of vessels for the year ending December 31, 1893.

Kind of vessel.	Arrivals.		Departures.	
	No.	*Tons.*	*No.*	*Tons.*
Steam	968	53,800	968	53,8
Sailing vessels	75	75,000	75	75,0
Yachts	30	2,400	30	2,4
Total	1,073	131,200	1,073	131,2

Estimated number of passengers carried by water, 75,000.

Estimated percentage of total trade of neighborhood carried by water, 50 per cent; probable increase of trade were the improvement completed, 50 per cent.

Average draft of vessels carrying phosphate, 18.1 feet; maximum draft 20.6 feet; average amount of phosphate carried by vessels, 1,500 tons.

O 13.

IMPROVEMENT OF WITHLACOOCHEE RIVER, FLORIDA.

The portion of this river which is included in the project for its improvement extends from its mouth in the Gulf of Mexico up to Pemberton Ferry, a distance of 77 miles. The country bordering the river consists mainly of hummock land and cypress swamps. Large quantities of fruit and vegetables are grown in its vicinity, and extensive deposits of phosphates are found in its lower reach.

Before improvement this river was so badly obstructed that no regular navigation was possible, and the river was used only for rafting cedar logs or for an occasional push boat. The obstructions consisted of ledges of limestone rock, sand bars, snags, and overhanging trees. At certain points the river expands in broad, marshy lakes and cypress swamps, in which there is no clearly defined channel. The general depth was from 1 to 7.5 feet, with a width of from 75 to 180 feet.

Operations for the improvement of this river have been carried on in accordance with the project submitted to the Chief of Engineers in 1879 by the officer then in charge, and published as part of Appendix K 18 to the Annual Report of the Chief of Engineers for 1880.

PROJECT OF IMPROVEMENT.

The project adopted is to improve the river by the removal of snags, overhanging trees, and loose rocks, and the deepening of some of the worst shoals and a bar at the mouth of the river, so as to enable boats drawing 2 feet to navigate the river during about one-half the year from the mouth to Hays Ferry, a distance of 71 miles. In 1886 the project was modified to permit the improvement to be continued as far as Pemberton Ferry, 6 miles from Hays Ferry.

OPERATIONS PRIOR TO JUNE 30, 1893.

Work was carried on under the following appropriations:

Act of—	
March 3, 1881	$7,500
July 5, 1884	3,000
August 5, 1886	3,000
August 11, 1888	5,000
September 19, 1890	5,400
Total	23,900

The work was done partly by hired labor and partly by contract. The entire river from the mouth to Pemberton Ferry was gone over, and the worst obstructions were removed.

At the close of operations the channel called for by the project had been formed between Pemberton Ferry and Dunnellon, though there are still obstructions which must be removed before navigation is safe.

During the progress of the work 85 snags and 464 overhanging trees were removed, 104 trees trimmed, 465 cubic yards of rock were blasted, 296 cubic yards of rock removed from the channel, and 128 linear feet of dams built.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

There were no operations during the past fiscal year.

The channel is now practically clear and available for navigation for boats drawing 2 feet of water during one-half of the year and it is believed that it can be easily maintained with an annual appropriation of $800.

Withlacoochee River is in the collection district of St. Marks, Fla., of which Cedar Keys is the nearest port of entry; nearest light-house is Cedar Key Light; nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1893, balance unexpended	$11.45
June 30, 1894, amount expended during fiscal year	1.53
July 1, 1894, balance unexpended	9.92
Amount (estimated) required for maintenance of existing project	800.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	800.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

There is no regular organized line of transportation on this river and it is practically impossible to obtain any commercial statistics for it. At the best such statistics would be wholly a matter of conjecture, as no one has any definite data to supply. A considerable quantity of phosphate is carried down the river by various firms, and much more will probably be carried next year, as extensive improvements, by private enterprise, are in contemplation.

O 14.

IMPROVEMENT OF HARBOR AT CEDAR KEYS, FLORIDA.

The harbor at Cedar Keys is the most northern harbor on the gulf side of the peninsula of Florida. It is formed by the tidal channels between a group of small islands or keys, of which Way Key, on which is situated the town of Cedar Keys, is the largest. Cedar Keys is the terminus of the central division of the Florida Central and Peninsular Railway. Its principal business is in cedar lumber, though it also forms a distributing point for supplies and general merchandise for an area to the north and south.

Prior to 1883 work had been done in this harbor for its improvement under appropriations aggregating $82,500.

An examination of the harbor, with a view to its further improvement, was made in November, 1883. A report thereon, together with a plan of improvement, was printed as Appendix N 30 to the Report of the Chief of Engineers for 1884.

PROJECT OF IMPROVEMENT.

The approved project, as therein described, is as follows: To obtain a channel 200 feet wide and with a least depth of 10½ feet from Cedar Keys to the Gulf of Mexico. A depth of 9½ feet formerly existed in this channel. The depth is limited by the existence of beds of rock under the entire channel from 9½ to 12½ feet below mean low water, which could only be removed at greater expense than the present and prospective commerce of the port would seem to warrant. The estimated cost of this project was $25,000.

This estimate was increased in 1887 to $66,000.

Operations have been carried on in accordance with this project under the following appropriations, viz:

Act of—	
July 5, 1884	$5,000
August 5, 1886	7,000
August 11, 1888	7,500
September 19, 1890	2,500
Total	22,000

The appropriation in the act approved September 19, 1890, was made in the following terms:

> Improving harbor at Cedar Keys, Fla.: Continuing improvement, $2,500, a part of which may be expended at Derrick Island Gap, on the inside channel from Suwanee River.

OPERATIONS PRIOR TO JUNE 30, 1893.

Between 1872 and 1881 cuts 200 feet wide and 11½ feet deep were made through the middle ground and through the outer bar. Under the appropriation of 1884 a cut of 12 feet deep, partly through rock, was started near Buoy No. 12. It was never completed, owing to the exhaustion of the appropriation. The appropriation of 1886 was expended in reopening the cut through the middle ground, giving it a direction as nearly as possible coincident with the direction of the tidal currents. It was made 70 feet wide and 10½ feet deep. The appropriation of 1888 was expended in widening the same cut to 200 feet entirely through the middle ground with a least depth of 9½ feet, excepting for a width of 60 feet along the east side, where it is 10 feet deep.

The work of dredging through the oyster bars in the vicinity of Derrick Gap, or the inside passage between the mouth of the Suwanee River and Cedar Keys, under the appropriation of September 19, 1890, was begun by the U. S. steam snag and dredge boat *Suwanee* on August 11, 1891, and ceased, owing to the exhaustion of funds, on September 18, 1891; 3,962 cubic yards were dredged.

The aggregate length of the cuts at this place is 1,196 feet, the width is 37½ feet, and the depth 6 feet at mean low water. Three hundred and ninety-eight cubic yards of sand and oyster shells were dredged at the crib stake of the East Pass, mouth of the Suwanee River, removing a small shoal at that place. A cut was made 380 feet long and 75 feet wide for 167 feet of its length and 37½ feet wide for the remainder of the distance. The depth was 4½ feet at mean low water. Seventeen channel stakes, consisting of palmetto piles, were placed in the passage. A three pile beacon was erected at the south end of the cut between Cedar Keys and Depot Key. A similar beacon was established at the northeast end of the cut in Cedar Keys Harbor.

There being no funds available no work was done during the past fiscal year.

The commercial importance of the town of Cedar Keys seems to have steadily declined during the past few years, so far as seagoing traffic is concerned. It would appear that the primary object of the improvement of the harbor as set forth in the project does not now exist. No appropriation having been made since 1890, it is presumed that for the present at least the work is to be discontinued.

For the last two or three years efforts have been made to secure commercial statistics of the harbor from business men of Cedar Keys, both by mail and personal application, but without success. Being the southern terminus of the Suwanee River route, the statistics of that work may be applied to Cedar Keys and will represent the greater portion of the water traffic of the place.

Cedar Keys is in the collection district of St. Marks, of which Cedar Keys is the headquarters. Nearest light-house, Cedar Keys Light; nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1893, balance unexpended	$11.30
June 30, 1894, amount expended during fiscal year	11.30
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	44,000.00

O 15.

IMPROVEMENT OF SUWANEE RIVER, FLORIDA.

The project for the improvement of the Suwanee River was adopted in 1879. The reach of the river covered by the project extended from Ellaville to its mouth in the Gulf of Mexico, a distance of 130 miles. At that time the obstructions in this portion of the river consisted of shoals composed of soft unstratified limestone mixed with flint, extending partly or entirely across the river, in some instances covered with shallow deposits of sand and in others bare; also snags and overhanging trees. The channels across these shoals were often narrow and very crooked. Their depth at mean low water would vary from 15 inches to 3 feet. At places large isolated limestone bowlders in the channel were constant sources of danger to navigation.

An examination of the river with a view to its improvement was made in 1879. The report thereon, dated August 26, 1879, may be found in the Report of the Chief of Engineers for that year, Appendix J 16. The estimated cost of the work to be done was $55,158.

PROJECT OF IMPROVEMENT.

The proposed improvement consists in deepening the bar at the passes by dredging, the removal of snags and overhanging trees along the river, and deepening and improving the channel at various places by the removal of rocks and snags, and construction of wing dams, so as to straighten, widen, and deepen the channel. The depth to be obtained is 5 feet through the bars at the passes for a width of 150 feet and up the river as far as New Branford, a distance of 80 miles. From there to Ellaville, a distance of 50 miles, the depth is to be 4 feet and the width 60 feet.

The following appropriations have been made for this work:

By act of—	
June 14, 1880	$5,000
March 3, 1881	3,000
August 2, 1882	5,000
July 5, 1884	5,000
August 5, 1886	5,000
August 11, 1888	15,000
September 19, 1890	3,000
July 13, 1892	3,000
Total	44,000

The act of 1888 provided that $10,000 of the amount appropriated "be expended in the purchase or construction of a suitable steam snag boat, with dredging and pile-driving machinery, to be used on the rivers of the west coast of Florida." Of the total appropriated $34,000 have therefore been available for work under the project.

With this amount a navigable depth of 5 feet at low water has been obtained from New Branford to the gulf; and a depth of 3 feet at low water from New Branford up as far as Hudson, about 10 miles below Ellaville.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1894.

Work under the appropriation of July 13, 1892, was begun November 14, and suspended because of exhaustion of funds on November 29, 1893. The work was done by the U. S. steam snag and dredge boat *Suwanee*. Five large snags and 2,873.1 cubic yards of material were removed, and 10 channel stakes established. Of the material dredged 1,696.4 cubic yards were removed from Derrick Gap, making 2 cuts, one 420 feet long and 41 feet wide (excepting for 100 feet, where it is 82 feet wide) and the other 125 feet long and 41 feet wide, the whole having a uniform depth of 5 feet at mean low water; 1,176.7 cubic yards were removed from the mouth of the river, making a cut 375 feet long and 41 feet wide, with a depth of water varying from 5½ to 6 feet at mean low water. All the shoals where dredging was required to enable boats to cross at extreme low water have been removed and the channel from North Key Shoal to Suwanee River plainly marked with palmetto cluster and single stakes.

The Suwanee River commerce comprises the movement of freight, farm produce, and naval stores to and from the railroads at Ellaville, New Branford, and Cedar Keys, and the rafting of cedar and other timber to the mills of the same towns. The roads are few and bad, and the bulky produce can only be moved to advantage by water, so that an improvement of the stream which will make it continuously navigable is essential to the prosperity of the river valley. Excepting the traffic to and from Cedar Keys there is no movement of freight out of the mouth of the river. This fact renders it unnecessary to extend the cuts previously made through the Suwanee Basin to the deep water of the gulf, and restricts the work under the project, which the present commercial status renders necessary, to the clearing of the river channel proper and the dredging of the oyster bars from the Derrick Island Pass at the mouth.

Several phosphate mines contiguous to the lower portion of the stream are being opened and barges have been constructed for the purpose of carrying the product of the mines to the mouth of the river and through the Suwanee Basin to a point near Cedar Keys, there to be loaded onto seagoing vessels. This makes the improvement of the channel at the mouth and through Derrick Gap entrance of still greater importance.

Suwanee River is in the collection district of St. Marks. Cedar Keys is the nearest port of entry. Nearest fort is Fort Marion. Nearest light-house, Cedar Keys Light.

Money statement.

July 1, 1893, balance unexpended		$1,357.89
June 30, 1894, amount expended during fiscal year:		
By Treasury Department	$195.20	
By Engineer Department	1,127.99	
		1,323.19
July 1, 1894, balance unexpended		34.70
Amount (estimated) required for completion of existing project		21,158.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

COMMERCIAL STATISTICS.

Commerce of Suwanee River, Florida.

[Furnished by Mr. D. E. Horn, secretary and treasurer Suwanee River Transportation Company.]

Article.	Gross tonnage.	Estimated value.
Cotton	100	$26,400.00
Fertilizers	30	540.00
Grain	200	6,000.00
Hides	5	450.00
Honey, sirup, etc	10	503.10
Lumber, rough	14,000	28,000.00
Lumber, dressed	1,100	5,500.00
Merchandise	6,025	1,084,500.00
Oranges	10	500.00
Ship stores	13,150	254,218.00
Fish and oysters	50	840.00
Hay	130	2,600.00
Staves and empty barrels	700	8,140.00
Cedar	1,312	51,878.00
Total	36,822	1,470,069.10

Vessels.

Steamer.	Arrivals.		Departures.	
	No.	*Tons.*	*No.*	*Tons.*
Three trips per week	156	183	156	183

Estimated number of passengers carried by water, 2,500.

Estimated percentage of total trade of neighborhood carried by water, 75 or 80 per cent. Probable increase of trade were the improvements completed, about 40 per cent.

APPENDIX P.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. F. A. MAHAN AND CAPT. PHILIP M. PRICE, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Apalachicola Bay, Florida.
2. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.
3. Flint River, Georgia.
4. Chattahoochee River, Georgia and Alabama.
5. Choctawhatchee River, Florida and Alabama.
6. Harbor at Pensacola, Fla.
7. Escambia and Conecuh rivers, Florida and Alabama.
8. Alabama River, Alabama.
9. Coosa River, Georgia and Alabama.
10. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.
11. Cahaba River, Alabama.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., July 10, 1894.

GENERAL: I have the honor to forward herewith annual reports * * * for the fiscal year ending June 30, 1894, upon the works under my charge.

* * * * * * *

Very respectfully, your obedient servant,

F. A. MAHAN,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

P 1.

IMPROVEMENT OF APALACHICOLA BAY, FLORIDA.

PLAN OF IMPROVEMENT.

The report of the examination of Apalachicola Bay, Florida, is printed in the Report of the Chief of Engineers for 1879, p. 823. The minimum depth of water over the bar at the mouth of the Apalachicola River was then 3.5 feet.

In accordance with the recommendations therein, a project was approved that contemplated the dredging of a straight channel through the bar at the mouth of the river to a depth of 11 feet and a width of 100 feet, to be afterwards increased to 200 feet, should the first cut produce results to warrant it, at an estimated cost of $100,000.

A survey of the mouth of the Apalachicola River and a portion of Apalachicola Bay was made in 1891 by Assistant Engineer Thomas Robinson, and the report thereon was submitted by Captain Price on May 15, 1891.

In accordance with the recommendations of this report the present project was approved, viz, to dredge a channel through the bar at the mouth of the Apalachicola River to a depth of 11 feet, with a width of 100 feet, to be afterwards increased to 200 feet should the first cut produce results to warrant it; and a channel through Bulkhead Shoal 9 feet deep and not less than 100 feet wide.

The commerce of Apalachicola Bay consists principally in the exportation of lumber. Ships generally enter through East Pass, between St. George and Dog islands, and anchor under the shelter of these islands about 24 miles from the town of Apalachicola. The lumber is carried on lighters, towed by tugs drawing from 5 to 7 feet, from Apalachicola to the anchorage grounds, and there loaded on ships for export. The natural channel to the anchorage grounds is nowhere less than 9 feet in depth, except at the bar at the mouth of the Apalachicola River and at Bulkhead Shoal. It is believed that the 9-foot channel dredged through Bulkhead Shoal in 1891–'92 will be reasonably permanent. Experience shows that the bar at the mouth of the Apalachicola River, which is composed of sediment brought down by the river, will require redredging at least every two years in order to maintain a channel of sufficient depth to accommodate the commerce unless the dredged channel be made wider and deeper than the appropriations have hitherto permitted. In this case redredging might be required less frequently.

APPROPRIATIONS.

March 2, 1833	$8,700	August 5, 1886	$12,000
July 4, 1836	10,000	August 11, 1888	20,000
March 3, 1839	9,900	September 19, 1890	20,000
June 14, 1880	10,000	July 13, 1892	20,000
March 3, 1881	10,000		
August 2, 1882	25,000	Total	155,600
July 5, 1884	10,000		

OPERATIONS TO JUNE 30, 1893.

The bar at the mouth of the Apalachicola River is about 7,300 feet in width between the 8-foot curves. A straight channel has been dredged across this bar from time to time, since 1881, as funds have been available. The dredged cut has never exceeded 90 feet in width and 9.5 feet in depth. It has gradually filled up with sediment after each dredging. In February, 1892, the dredging of a straight channel about 4,000 feet long, 120 feet wide, and 9 feet deep across Bulkhead Shoal was completed.

Between November, 1892, and April, 1893, the channel at the mouth of the river was redredged along the old lines across the bar. The cut was made with a width varying from 120 feet at its inner end to 100 feet at its outer end, with a uniform depth of 8 feet.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer Thomas Robinson, in local charge of the work, reports as follows:

No dredging or other channel work was done. In April, 1894, an examination was made of the channel dredged across the Bulkhead Shoal in 1892. There appeared to be no change in depth since the dredging was completed, and under normal conditions of the currents of the bay the Bulkhead Channel will be permanent. In the same month the channel at the mouth of the river was examined, and the soundings showed a large infilling of silt. For a distance of 2,000 feet toward the inner edge of the bar the channel had a depth of only 5.5 feet at mean low water or a shoaling since the dredging was completed one year ago of 2.5 feet.

This examination confirms the estimates of previous years, viz, that so long as dredging alone is resorted to an annual accumulation of 60,000 or 70,000 cubic yards of deposit must be removed to maintain a fair channel for the commerce of the port of Apalachicola, and in the light of past experiences a least sum of $20,000 will be required for an 8 by 100 foot channel the full extent of the bar. A wider channel would be better for the needs of commerce and would be proportionately more permanent.

In my last report it was suggested that some simple "training wall" or dam to control in part the tidal and river currents, would materially help matters; but no further light has been obtained on the subject and I can do nothing more than to recall the suggestion.

RECOMMENDATIONS AND ESTIMATES.

The preservation of a passable channel through the bar at the mouth of the Apalachicola River is essential to the carrying on of the very considerable commerce of the port of Apalachicola. Experience has shown that the removal, at least once in two years, of from 60,000 to 70,000 cubic yards of deposit is required in order to secure a channel 100 feet wide by 8 feet deep, and that a deeper channel would probably be more durable, and an estimate of $50,000 is therefore submitted as the amount that can be profitably expended during the fiscal year ending June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$171.64
June 30, 1894, amount expended during fiscal year	79.83
July 1, 1894, balance unexpended	91.81
July 1, 1894, outstanding liabilities	9.54
July 1, 1894, balance available	82.27
Amount that can be profitably expended in fiscal year ending June 30, 1896	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

[Furnished by the collector of customs.]

Custom-house receipts from all sources.

Duties on imports	$17.85
Tonnage dues	1,725.30
Official fees	500.32
Total	2,243.47

	Number.	Tonnage.
Vessels entered	108	52,487
Vessels cleared	112	55,100

Vessels employed in the traffic of Apalachicola	150
Superficial feet of timber and lumber exported	50,150,000
Estimated number of vessels and river steamers arrived and departed	750
Estimated tonnage of above vessels	89,600
Value of exports to—	
Foreign countries	$263,666.00
Coastwise ports	225,000.00
Total value of exports	488,666.00
Value of imports from—	
Foreign countries	51.15
Coastwise ports	210,000.00
Total value of imports	210,051.15
Total value of imports and exports	698,717.15
Estimated value of exports to coastwise ports by sail vessels, river steamers, and coasting steamers which do not enter or clear from the custom-house	1,120,000.00
Estimated value of imports	1,350,000.00

There are 8 sawmills, which turn out 450,000 superficial feet of lumber per day, with shingle attachments turning out 350,000 shingles per day; 3 oyster-canning factories, with a capacity of 60,000 cans per day; 1 fish-packing establishment, which packs about 6,000 barrels per annum; 1 ice factory, manufacturing 7 tons per day.

Since last year the Carabelle and Tallahassee Railroad has been completed, which has induced the starting of several enterprises, such as sawmills, naval depots, and fresh fish packing establishments. All the products of the above will be brought to and shipped from this point.

For the reasons above stated, I am confident that the business of the next fiscal year will be double that of the year just ended.

P 2.

IMPROVEMENT OF APALACHICOLA RIVER, THE CUT-OFF, AND LOWER CHIPOLA RIVER, FLORIDA.

PLAN OF IMPROVEMENT.

The report of the examination and survey of the Apalachicola River is printed in the Report of the Chief of Engineers for 1873, p. 698.

The Apalachicola River is formed by the junction of the Chattahoochee and Flint rivers and is about 105 miles long from the junction to Apalachicola Bay. The channel is nowhere less than 6 feet deep, but is more or less obstructed after each freshet in the Chattahoochee and Flint rivers by logs and snags brought down by those rivers, and by trees which have fallen from its own heavily timbered banks.

At Moccasin Slough and at the Upper and Lower Elbows the channel is very narrow and crooked and difficult to navigate and needs straightening and widening.

The act of August 11, 1888, directed an examination of the Chipola River, Lee Slough, and the Cut-off. The report of this examination is printed in the Annual Report of the Chief of Engineers for 1889, p. 1416.

The act of September 19, 1890, appropriated $2,000 for maintaining the existing works on the Apalachicola River, including Lee Slough. The original project was modified accordingly, and now provides for securing a channel 100 feet wide and 6 feet deep at low water in the Apalachicola River, by the removal of snags and overhanging trees and widening and straightening Moccasin Slough and the Elbows; and for securing a channel through the Cut-off, Lee Slough, and the Lower Chipola River 60 feet wide and 5 feet deep at low water, by the removal of logs and snags and overhanging trees. The estimated cost of completing the original project was $80,333, and of the improvement of the Cut-off, Lee Slough, and the Lower Chipola River, $7,500.

APPROPRIATIONS.

May 23, 1828	$3,000	August 2, 1882	$2,000
April 23, 1830	2,000	July 5, 1884	1,000
March 2, 1831	8,000	August 5, 1886	1,000
June 23, 1874	10,000	August 11, 1888	2,000
March 3, 1875	10,000	September 19, 1890	2,000
June 18, 1878	8,000	July 13, 1892	5,000
March 3, 1879	5,000		
June 14, 1880	2,000	Total	62,500
March 3, 1881	1,500		

OPERATIONS TO JUNE 30, 1893.

Between 1874 and 1880 the accumulation of logs and snags was removed from the channel of the Apalachicola River, and a partial improvement was made at Moccasin Slough and the Elbows. Since 1880 the appropriations have only sufficed to remove the snags and logs annually brought down by the freshets in the rivers above. There is no plant belonging to this river, and the annual snagging work was done by the Chattahoochee River snag boat at times when the water in the latter river was too high for channel work.

During the winter of 1891-'92 a large amount of drift and obstructing timber was removed from the Cut-off, which enabled the river steamers to run to Wewahitchka, Fla. During the months of January, February, and March, 1893, the snag boats *Flint* and *Chattahoochee* were loaned to this improvement, and after clearing the drift and overhanging timber from the Apalachicola River, the Cut-off, and the Lower Chipola River, the boats succeeded in opening a steamer passage through Lee Slough. This new run for the river steamers, although it is incomplete, and serviceable only on the up-river voyage at moderate stages of water, is of great benefit in the shipment of honey, oranges, and other crops of the neighborhood, and a saving of time to steamers.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer Thomas Robinson, who has been in local charge of the work, reports as follows:

> From lack of money no channel work was done. At present date the condition of the improvement is, with the exception of drift logs and snags brought in during the winter freshets, about the same as reported June 30, 1893, viz, the channel of the river is fairly free from obstructions, except those that are due to the sharp bends at the Elbows and Moccasin Slough.
>
> The Cut-off and Lower Chipola River (including Lee Slough) are now open, and if carefully handled the steamboats can come through this waterway on the upstream passage; but the downstream one is a tedious and dangerous one.
>
> Under the approved project the improvement of the main channel of the Apalachicola River may be considered nearly complete, while that of the Cut-off and the Lower Chipola River (including Lee Slough) is only about half done, and until this part of the work is finished the practical end designed by the improvement remains unattained.
>
> It is recommended that an appropriation be made to complete this improvement in one season and render available at once the work already done. For the completion of the work no new plant is needed, but, as before, the snag boats of the Chattahoochee or Flint rivers, or both, can be utilized when otherwise lying idle during the winter high water.

ESTIMATES.

For the maintenance of the work as it now is	$2,000
To complete opening of Lower Chipola River	5,000
To make improvements at the Elbows and Moccasin Slough	4,000
Total	11,000

All of which can be profitably expended during the fiscal year ending June 30, 1896.

RECOMMENDATIONS AND ESTIMATES.

It is estimated that $2,000 will be required for the annual snagging operations on the Apalachicola River proper; that the improvements needed at the Elbows and Moccasin Slough can be completed for $4,000, and that the opening of a practicable steamboat channel (for passage in both directions) can be completed through the Cut-off and the Lower Chipola River for $5,000 by using the Chattahoochee and Flint River snag boats at times when they are not employed on those rivers, respectively, on account of high water.

The country contiguous to these waterways is entirely dependent upon them for transportation and mail facilities, and it is very important that the many steamboats engaged in commerce upon them should be able to make their trips with regularity and safety.

It is therefore respectfully recommended that the entire amount asked for above be made in one appropriation.

Money statement.

Amount that can be profitably expended in fiscal year ending June 30, 1896	$11,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Cut-off and Lower Chipola River.

Hon. J. D. Pirrong, of Wewahitchka, Fla., writes:

There were shipped during the year:

Articles.		Quantity.	Tons.
Oranges	boxes	30,000	1,125
Honey	pounds	312,000	156
General freight	do	2,071,504	1,035
Sawed lumber	feet, B. M.	3,000,000	3,250
Square (hewn) lumber	do	500,000	

By receiving of freights from and delivering our products directly to the steamboats at Wewahitchka, Pease, Magnolia, and Bryant's landings, instead of transferring them across the lakes' route by wagon and ferry, we have made a saving to the community of over $9,000.

The advantages of the partially opened Lee Slough to the lumbermen can not be estimated; but they are enormous.

By pushing the opening of the slough to completion, the river steamers will be able to make the passage on the descending as well as the ascending trips, and the mail and passengers can go on board at our landings instead of crossing to Iola to meet a steamer, which, perchance, has already previously gone by the place.

The advantages of a prompt mail delivery to us may be estimated, when I say that, taking the figures of the last month of March—which can not be taken as an unfair average—the post-office business for the year would be:

Packages and letters sent out	17,400
Packages and letters received	24,000
Money orders issued	$13,036.80
Money orders paid	6,663.96

Yours truly,

J. D. PIRRONG.

The commercial statistics of the main channel of the Apalachicola River are so combined with those of the Chattahoochee River that a true separation is impossible, and a reference is made to that river for figures.

P 3.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendation contained in the reports of examinations and surveys of the Flint River, printed in the Annual Reports of the Chief of Engineers of 1873, p. 707, and 1879, p. 818.

The project provides for a low-water channel 3 feet deep and 100 feet wide from the junction with the Chattahoochee River to Albany, Ga., an estimated distance of 105 miles, and for a navigable channel for light-draft steamers, at moderate stages of water, from Albany to Montezuma, Ga., an estimated distance of 77 miles, to be secured by the removal of snags and overhanging trees, cutting through the rock reefs, and deepening sand bars by works of contraction and shore protection.

Below Albany the work consists principally in excavating the required channel through the rock bottom of the river, and the improvement effected is of a permanent character. The few snags and logs brought down by the winter freshets must, however, be removed annually.

From Albany to Warwick, 38 miles above, low-water navigation is prevented by a series of rock shoals, on which the low-water depth is from 6 to 18 inches. Between Warwick and Montezuma the improvement consists mainly in the removal of snags and logs and overhanging trees.

Experience in working on the river above Albany has shown that a practicable and useful navigation of this section of the river at moderate stages of water can probably be secured only by providing slack-water navigation by dams and locks, and that the work now being done is of no commercial benefit. Two bridges, without draw openings, at distances, respectively, of 16 and 41 miles above Albany, now prohibit steamboat navigation at the higher stages of water, but no proceedings have been instituted to compel the insertion of draw spans in these bridges, for the reason that no complaint has ever been made against them, and there appears to be no desire to operate a steamboat on this section of the river.

APPROPRIATIONS.

For Chattahoochee and Flint rivers:	
June 25, 1871	$25,000
March 3, 1875	25,000
August 14, 1876	20,000
Total	*70,000
June 18, 1878	10,000
March 3, 1879	7,000
June 14, 1880	20,000
March 3, 1881	$15,000
August 2, 1882	25,000
July 5, 1884	20,000
August 5, 1886	20,000
August 11, 1888	20,000
September 19, 1890	20,000
July 13, 1892	15,000
Total	172,000

OPERATIONS TO JUNE 30, 1893.

A moderately efficient working plant has been provided for rock excavation below Albany, Ga., and for snagging operations above Albany.

Below Albany.—Some loose rock excavation had been done at all the shoals between Albany and Bainbridge, and the material disposed of in spur dams. There was a completed and permanent channel from Albany to Newton, a distance of 33¼ miles. Between Newton and Bainbridge, a distance of 42 miles, the channel was passable, with care, at moderate stages of water, but at low water was in many places impracticable. Between Bainbridge and the mouth of the river, a distance of 36 miles, the river was navigable throughout the year, and required but little improvement aside from the removal of drift logs and snags brought in by the winter floods.

Above Albany.—Snags and other drift and overhanging trees had been removed from the channel from time to time between Albany and Montezuma, and some of the loose bowlders had been removed from the channel between Albany and Warwick.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer Thomas Robinson, who has been in local charge of the improvement, reports as follows:

Below Albany.—Early in July, 1893, the drilling barge, having finished the removal of the reef at the foot of Ferguson Shoals, was dropped down the river, removing overhanging trees from the banks and scattered logs and snags and loose bowlders from the channel, 9.5 miles to Odoms Shoals, where steady work was found in blasting and removing large isolated rock masses. (The term "shoals," as applied to these obstructions, is rather misleading, for in reality they are nothing but separate lumps of silicious rock left where the water has cut a deep channel through the softer limestone.) This work completed, the barge was dropped down the river 3 miles, to Newton Shoals, where excavation was continued until the exhausted appropriation put a stop to fieldwork and the boats were taken up the river to lie up in a safe place near Baconton, Ga.

Between Ferguson and Newton Shoals there were removed from the channel 500 overhanging trees, 202 stumps, 79 snags and logs, and 1,008 cubic yards of rock. This rock was deposited, where necessary, in the construction of dams and breakwaters. As these obstructions were scattered a map was considered unnecessary and no surveys were made for one.

Above Albany.—No channel work was done between Albany and Montezuma. Work on the snag boat *Flint* was continued and completed except setting up the pilot house and the woodwork of the wheel.

CONDITION OF IMPROVEMENT JUNE 30, 1894.

Below Albany.—There is a completed channel, navigable at all seasons of the year between Albany and Newton, a distance of 33¼ miles. Between Newton and Bainbridge navigation is impossible, at low water, on account of the rock shoals. Below

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*Of this amount $18,000 was expended on Flint River.

Bainbridge the stream is navigable at all seasons of the year, and this part of the river is well used by the steamers navigating the Chattahoochee and Apalachicola rivers.

Above Albany.—Between Warwick and Montezuma the channel is deep enough, but narrow and crooked and more or less obstructed by logs and snags. Between Warwick and Albany the channel is obstructed by rock shoals, and low bridges without draw openings. No attempt at navigation of this part of the river was made during the past year, none appears likely in the future, and hence the obstructions mentioned do not count.

RECOMMENDATIONS AND ESTIMATES.

Below Albany.—It is recommended that the work of clearance of the rock shoals be continued down the river to Bainbridge, and that the working plant be increased by the addition of a small dredging machine for handling loose material. Such a machine would accelerate the work and greatly reduce the cost of it. Below Bainbridge it is recommended that the drift logs, snags, etc., be removed by the snag boat which plies the Chattahoochee River.

Above Albany.—For the Flint River above Albany, no further recommendation is made for any work or appropriation.

ESTIMATED COST FOR FISCAL YEAR ENDING JUNE 30, 1896.

Repairs and additions to present plant	$4,000
Drilling barge crew, eight months, at $1,000	8,000
Snag-boat crew, two months, at $1,000	2,000
Office, engineering and contingencies	2,000
	16,000
New dredging machine (estimated)	10,000
Crew of same, eight months, at $1,000	8,000
Two additional rock barges, at $1,000	2,000
	20,000

Money statement.

July 1, 1893, balance unexpended	$9,606.83
June 30, 1894, amount expended during fiscal year	7,560.76
July 1, 1894, balance unexpended	2,046.07
July 1, 1894, outstanding liabilities	252.33
July 1, 1894, balance available	1,793.74
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	36,000.00

COMMERCIAL STATISTICS.

Assistant Engineer Thomas Robinson, in local charge of the improvement, reports as follows:

Between Albany and Montezuma.—None. There has been no commercial navigation of this section of the river.

Between Albany and Bainbridge, the commerce was confined to transportation of naval stores by flatboats, and sawed and round lumber by rafts. For neither of these could definite figures be obtained, but from various hearsay statements a fair estimate for naval stores is 700 barrels, 100 tons; round lumber, 4,320,000 feet, B. M., 10,800 tons; sawed lumber, 2,000,000 feet, B. M., 5,000 tons.

Mr. Ed. L. Wight, ex-president of the Albany Navigation Company, writes:

"No boat has made a trip on Flint River since January, 1893, so far as I know.

For three years previously the steamer *City of Albany* made regular trips between Albany and Bainbridge when the water was not too low; but owing the fact that very dry weather prevailed each fall, the river could not be successfully navigated by a loaded boat and we had to tie up, and thereby lose the best business of the year; we finally decided to sell our boat, and did so early in 1893. If the river was put in condition (as might be done) so it could be navigated all the year round, I think an excellent business could be done and the people along the river greatly benefited."

Below Bainbridge the commerce of the Flint River is blended with that of the Chattahoochee and Apalachicola rivers in such manner as to make a separation of the two impossible, and reference is made to the commercial statistics of the Chattahoochee River.

P 4.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

GENERAL IMPROVEMENT.

Plan of improvement.—The present plan of improvement was adopted in accordance with the recommendations contained in the reports of examinations and surveys of the river printed in the Annual Reports of the Chief of Engineers for 1872, p. 584, and 1873, p. 699.

The project provides for a low-water channel 4 feet deep and 100 feet wide, from Columbus, Ga., to Chattahoochee, Fla., an estimated distance of 224 miles, by the removal of snags and logs from the channel and overhanging trees from the banks, cutting a channel through the rock shoals and deepening sand bars by works of contraction and shore protection.

The improvement, at many points, is of a permanent character, the bottom of the river being of rock and the banks not easily eroded; at a few points the obstructions consist of shifting sand bars and caving banks. Each freshet brings a considerable number of logs and snags into the channel, which must be removed annually.

In addition to such amounts as may be appropriated for continuing the improvement of the river, an annual expenditure, estimated at $10,000, will be required for the maintenance of a stern-wheel snag boat and for the repair of works of contraction and shore protection.

APPROPRIATIONS.

February 24, 1835	$2,000	June 4, 1880	$20,000
		March 3, 1881	20,000
Chattahoochee and Flint rivers:		August 2, 1882	25,000
June 23, 1874	25,000	July 5, 1884	35,000
March 3, 1875	25,000	August 5, 1886	20,000
August 11, 1876	20,000	August 11, 1888	20,000
		September 19, 1890	20,000
Total	*70,000	July 13, 1892	†25,000
June 18, 1878	18,000	Total	218,000
March 3, 1879	15,000		

OPERATIONS TO JUNE 30, 1893.

Condition of improvement June 30, 1893.—The work done last year at Mound Bar had stood well, and the channel over the bar was in good condition and gave the boats no trouble. All other places the unimproved bars were a source of constant delays to navigation at times of low water, and this was especially true of the bar in St. Francis Bend. The old works of contraction and other improvements made some years ago at the shoals near Columbus, Ga., and at the Woolfolk, Upatoie, and Sheel Creek bars were badly out of repair (they are so at date of this report, and becoming worse as time goes on), and boats frequently go aground at these places.

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*Of the joint appropriations $52,000 was expended on the Chattahoochee River.

†Of which $5,000 were to be expended between West Point and Franklin.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer Thomas Robinson, who has been in local charge of the work, reports as follows:

The snag boat *Chattahoochee* having removed the obstructions scattered throughout the full length of the river, was joined by the pile-driving barge in July, and both crews began the improvement of Woolfolk Bar, 9 miles below Columbus, Ga. This work involved the removal of obstructions to allow the low water to follow the same channel as that of moderately high river, and the construction of dams and bank protections to confine the stream to the desired course. The funds available were not sufficient to complete the improvement, and the work attempted was designed more especially to aid the stream in scouring its own channel during the winter freshets. To this end 36 logs and snags, 30 cubic yards of rock dump, and 33 piles (remains of a previous work) were removed, and an area 100 yards long by 15 yards wide was plowed twice through the sand and gravel of the bar, and two spur dams were built out from the Georgia bank to partly close the low-water run and deflect the stream into the proposed channel. A rise of the river stopped for a few days the mid-river work, and advantage was taken to drive piles along the right bank of the river preparatory to the construction of permanent transverse dams and of bank protection. This outlined work of construction covered the driving and trimming of 477 piles, cutting and placing 195 cords of brush, the deposit of 30 cubic yards of rock and two old boilers as ballast, and the use of 2,800 feet, B. M., of lumber for wales, braces, etc., on the dams.

This work done, the boats were taken down to Burdock Landing, sundry repairs for preservation were made to the cabin of the snag boat, and to the hull and cabin of the pile driver, and the plant was laid up.

A barge for the transportation of rock, brush, etc., had been needed for some years, and when this year the old hull of the snag boat *Flint* was available for the purpose, authority was obtained to transfer and repair it for the Chattahoochee River. Upon stripping the old boat for repair it was found to be in bad condition in the upper timbers, and more work needed than anticipated for its repair.

These repairs cost:

Choice lumber (6,080 feet, B. M.)	$121.60
Labor and mechanics	227.50
Bolts, nails, paints, oakum, etc	56.00
Total	405.10

CONDITION OF IMPROVEMENT JUNE 30, 1894.

The conditions of things in channel have changed but little since June 30, 1893.

The working plant is one year older, and that means much for boats beginning to decay. The snagboat *Chattahoochee* has served its day. Its wheel was stripped and shear frame taken down and put on the bank to lighten the load and insure a safe floatation while laid up. Nothing further can be done with this boat until a new hull is built for it and the old cabin and machinery transferred thereto. This will cost $15,000. The pile-driving barge needs repairs of deck, deck beams, etc., and the various bateaux and skiffs must have thorough overhauling before another season's work is begun.

RECOMMENDATIONS AND ESTIMATES.

The commerce of the Chattahoochee River warrants a good navigable channel. Four boats, weekly, have been making through trips from Columbus, Ga., to Apalachicola, Fla., but they could carry full loads only at times of high water. It is recommended that all the old works of improvement, etc., as outlined above, be put in repair, and that the necessary new improvements be pushed as rapidly as possible. To do this the old pile-driver, barges, etc., must be put in repair, the snag boat must be renewed, and an increase of working plant should be made by the purchase or building of some dredging machine.

Cost is estimated thus:

Removing annual accumulation of drift, snags, etc	$5,000
Repairs of plant and new dredging machine	12,000
Completion of improvement at Woolfolk Bar	7,000
Repairs to works of contraction—	
Near Columbus, Ga	15,000
At Upatoie Creek	5,000
At Shell Creek	5,000
Excavation and control of water in St. Francis Bend	30,000
Excavation of rocks, etc., at King Rock, Rock Island, etc	21,000
Total	100,000

Money statement.

July 1, 1893, balance unexpended	$8,156.40
June 30, 1894, amount expended during fiscal year	7,049.60
July 1, 1894, balance unexpended	1,106.80
July 1, 1894, outstanding liabilities	141.67
July 1, 1894, balance available	965.13
Amount that can be profitably expended in fiscal year ending June 30, 1896	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The business done by steamboats herein named has been compiled in the following table from statements furnished by the agents of the Central Line, the People's Line, the Merchants and Planters' Line, and the Columbus and Gulf Navigation Company, all of Columbus, Ga.

The steamers run from Columbus, Ga., to Chattahoochee, Fla., thence up the Flint River to Bainbridge, Ga., thence down to Apalachicola, Fla. On the return trip they call at Bainbridge, thence to Columbus. Stops are made on both the down and up river journeys at all landings where business is offered.

Stern-wheel steamboats.	Registered tonnage.	Draft of water.		Round trips between Columbus, Ga., and Apalachicola, Fla., via Bainbridge, Ga.	Passengers.
		Light.	Loaded.		
		Inches.	*Feet.*		
Fannie Fearn	179.32	24	5	20	[illegible]
Queen City	150.03	22	5	30	[illegible]
Apalachee	161.90	28	5		
Flint	135.51	18	5	50	[illegible]
Pactolus	149.12	24	5		
Naiad	173.77	18	4½	30	[illegible]
Bay City	87.45	20	4	26	[illegible]

Freight carried.

Articles.	Quantity.	Tons.
Cotton .... bales..	24.514	6,007
Cotton seed .... sacks..	9,015	541
Fertilizers .... do...	34,124	3,355
Hides and skins .... packages..	224	14
Live stock .... head..	344	147
Lumber .... feet..	85,540	185
Provisions .... packages..	263,004	7,382
Grain .... sacks..	34,562	2,441
Miscellaneous freight .... packages..	197,385	7,776
Naval stores .... barrels..	11,051	2,942
Cotton-seed hulls .... bales..	1,965	10
Bricks	467,225	1,084
Shingles	3,363,880	604
Total	....	32,478

Estimated value of above freight (in round numbers), $2,039,000.

In addition to the business done by boats, quantities of hewed and round timber are rafted down the river; no definite figures of such business are kept, but the amount will be covered by the returns for Apalachicola Bay.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA, BETWEEN WEST POINT AND FRANKLIN.

PLAN OF IMPROVEMENT.

This section of 38 miles of the river consists of a series of pools varying in length from one-half to 5 or 6 miles, separated by rock shoals and rapids, in some of which the fall is as great as 8 feet to the mile. In the pools the width of the river is from 300 to 500 feet, with a channel nowhere less than 4 feet deep. At the shoals the river is much wider, with numerous islands, and low-water depths in many places of only a few inches. The bottom is generally of rock and the banks are stable. There are few, if any, sand bars and but few snags.

An examination and partial survey of the Chattahoochee River from Gainesville, Ga., to Columbus, Ga., which includes the section between West Point and Franklin, was made in 1879, under the direction of Lieut. Col. (then Maj.) W. R. King, whose report is printed on page 1705 of the Report of the Chief of Engineers for 1880. This report stated that the improvement of the section of river from the West Point and Atlantic Railroad bridge, near Atlanta, to West Point, a distance of 108 miles, appeared entirely feasible, at an estimated cost of $486,474, which includes the cost of eight locks.

The river and harbor act of September 19, 1890, provided for a preliminary examination of the Chattahoochee River, Georgia and Alabama, between West Point and Franklin. This examination was made in November, 1890, by Assistant Engineer Thomas Robinson, and the report of Capt. Price thereon is printed at page 1756 of the Report of the Chief of Engineers for 1891. From the cursory examination made by passing down the river in a skiff, at a stage above low water, Mr. Robinson concluded that the section of river under consideration could be made navigable by the construction of one lock at Bentley Mill and by rock excavation and training dams at the other shoals and rapids. For the reasons stated in the report it was recommended that this section of river should be surveyed for the purpose of submitting plans and estimates for its improvement. The Chief of Engineers and the Division Engineer did not concur in this recommendation, and no survey was made.

The river and harbor act of July 13, 1892, contained this provision:

> Improving Chattahoochee River, Georgia and Alabama: Continuing improvement, twenty-five thousand dollars, of which five thousand dollars are to be used on that portion of the river between West Point and Franklin.

After the passage of this appropriation it was learned that the Chattahoochee Navigation Company, which claims to have spent about $16,000 in improvement work on the river, had employed Mr. David C. Barrow, jr., a civil engineer, to make a survey between West Point and Franklin in 1890. The Chattahoochee Navigation Company furnished this office with a copy of his report and maps.

On July 26, 1892, the following project of improvement for this section of river was submitted by Capt. P. M. Price, Corps of Engineers:

> *Project.*—To remove the lesser rock shoals, sand and gravel bars by excavation and by works of contraction; to remove overhanging trees from the banks, and snags, logs, and other obstructions from the channel, and to overcome the more serious obstructions by the construction of locks and dams to give a minimum depth of 3 feet at low water in the channel between West Point and Franklin, a distance of 38 miles.
>
> I recommend further that a party be organized for working on the shoals between West Point and Bentley Mill, and continue working until the shoals are put in as good condition as practicable, or until the funds are exhausted.
>
> After the completion of the survey at Bentley Mill, and after experience has shown the average cost per cubic yard of the work on the shoals, I shall submit an estimate of the cost of completing the improvement.

These recommendations were approved by letter of August 5, 1892.

APPROPRIATIONS.

July 13, 1892 (allotment from appropriation for improving Chattahoochee River, Georgia and Alabama)	$5,000

CONDITION OF IMPROVEMENT JUNE 30, 1893.

The work of improving this section was commenced August 15, 1892, at Flat Rock Shoals, and continued through the working season. At the time of suspension the improvement of these shoals was nearly completed.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer D. M. Andrews, who was in local charge of the work, reports as follows:

> The work of channel excavation at Flat Rock Shoals was completed August 31, 1893, and work of a similar character commenced at Roberts Shoals, about a quarter of a mile below. The work at these shoals was suspended October 16, 1893, on account of the exhaustion of the appropriation. The blasting had been finished, but some of the blasted material still remains to be removed.
>
> On October 12, 1893, while the river was at its lowest stage, the steamer *Spray* passed through the channels at Roberts and Flat Rock Shoals without encountering any obstruction, except at Roberts Shoals, from unremoved blasted material.
>
> A low-water channel of 50 feet in width and a depth of 3 feet has been secured at Flat Rock Shoals.
>
> As stated in my report for 1893, the employment of primitive hand methods, necessitated by the smallness of the appropriation, has added much to the cost of the work, while an unusually rainy summer and consequent high water (there having been only fifty-eight working days during the months of June, July, August, September, and to the middle of October, when the work was suspended), has helped to increase the cost.
>
> The following is a statement of expenditures and cost of channel excavation. It must be borne in mind, however, that this sum includes the cost of depositing the

excavated material in and building the necessary wing and training dams for concentrating the water in the channel and reducing the slope.

Flat Rock Shoals:		
Plant	$25.15	
Labor	736.72	
Engineering and superintendence	15.00	
Subsistence	240.99	
Miscellaneous	40.73	
Material	276.10	
		$1,334.69
Amount expended during the previous fiscal year		2,895.36
Rock excavation, 216 cubic yards, at $6.48 per cubic yard; 178 linear feet training dams.		
Roberts Shoals:		
Plant	$0.50	
Labor	421.47	
Engineering and superintendence	30.00	
Subsistence	56.73	
Miscellaneous	19.74	
Material	25.70	
		554.14
Rock excavation, 24.86 cubic yards at $6.46 per cubic yard.		
Amount expended during previous fiscal year, survey at Bentley Mill		121.14
Available balance June 30, 1894		94.67
Amount appropriated		5,000.00

The small balance of the appropriation available having prohibited a survey of the part of the river which has been improved, no map is submitted.

RECOMMENDATIONS AND ESTIMATES.

As the Division Engineer of the Southwest Division has expressed the opinion that this part of the river is not worthy of improvement, and as this view has received the approval of the Chief of Engineers, it is recommended that work on this part of the river be abandoned.

Therefore no estimate for further appropriation is submitted.

Money statement.

July 1, 1893, balance unexpended	$2,240.39
June 30, 1894, amount expended during fiscal year	2,145.72
July 1, 1894, balance unexpended	94.67

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics upon this improvement, but as yet no success has been met with.

During the fiscal year ending June 30, 1893, freight was carried on this portion of the river to the amount of 4,873 tons, the estimated value of which was $1,200,000.

P 5.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of examinations and surveys of the river, printed in the Annual Reports of the Chief of Engineers for 1872, p. 588, and 1889, p. 1423.

The project provides for obtaining a low-water navigable channel from the mouth of the river to Newton, Ala., an estimated distance of 162 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by excavating rock shoals and by deepening sand bars by works of contraction and shore protection.

At Caryville, Fla., 100 miles above its mouth, the river is crossed by the Pensacola and Atlantic Railroad.

The country along the river below Caryville is sparsely settled, and the business consists almost exclusively in the cutting and rafting of lumber. This portion of the river is so little used for commercial purposes that no work has been done on it for several years past.

Geneva, Ala., 25 miles above Caryville, is a thriving town and is the trading and shipping point for a rich agricultural region surrounding it, which is rapidly increasing in population, and which is dependent upon the river for the transportation of its products and supplies. Nearly all the commerce of the river is carried on between Geneva and Caryville, the nearest railroad point. Consequently, during recent years, the improvement has been confined mainly to this section of the river. The channel has been pretty well cleared of the accumulation of snags and logs which formerly obstructed it, but low-water navigation is still impeded by several sand bars.

During the low-water season of 1892 the deepening of these bars by works of contraction and shore protection was begun, and it is proposed to continue this work as funds are available.

Between Geneva and Hollis Bridge, 30 miles above, the river is obstructed by snags and sunken logs and occasionally by sand bars.

The obstructions have from time to time been partially cleared out between Geneva and Pate Landing, 25 miles above, and when freight is offered steamboats run to Pate Landing at favorable stages of water.

Between Hollis bridge and Newton, 7 miles above, low-water navigation is prevented by a series of nine shoals, formed by strata of very compact blue clay. Since the completion of the Alabama Midland Railroad from Montgomery, Ala., to Bainbridge, Ga., which passes through Newton, the urgent necessity for the improvement of this section of the river no longer exists.

It is doubtful if this section of the river would now be much used even if the projected improvements, which contemplated excavating channels through the shoals and confining the water thereto by training dams, were completed. From experience with similar work on other rivers, it is also doubtful whether this method of improvement will provide for satisfactory navigation at low water, and it is probable that this can only be secured by a system of slack-water navigation by locks and dams, at a cost not warranted by any prospective benefit to be derived therefrom. Unless otherwise directed, it is, therefore, not proposed to do any work on the river above Pate Landing until the section between this point and Caryville has been put in good navigable condition for all stages of water.

After this is accomplished the annual cost of maintaining the snag boat for the removal of logs and snags brought in by the winter freshets, and for keeping the contraction and shore-protection works in repair, is estimated at $6,000.

excavated material in and building the necessary wing and training dams for concentrating the water in the channel and reducing the slope.

Flat Rock Shoals:		
Plant	$25.15	
Labor	736.72	
Engineering and superintendence	15.00	
Subsistence	240.99	
Miscellaneous	40.73	
Material	276.10	
		$1,334.69
Amount expended during the previous fiscal year		2,895.36
Rock excavation, 216 cubic yards, at $6.48 per cubic yard; 178 linear feet training dams.		
Roberts Shoals:		
Plant	$0.50	
Labor	421.47	
Engineering and superintendence	30.00	
Subsistence	56.73	
Miscellaneous	19.74	
Material	25.70	
		554.14
Rock excavation, 24.86 cubic yards at $6.46 per cubic yard.		
Amount expended during previous fiscal year, survey at Bentley Mill		121.14
Available balance June 30, 1894		94.67
Amount appropriated		5,000.00

The small balance of the appropriation available having prohibited a survey of the part of the river which has been improved, no map is submitted.

RECOMMENDATIONS AND ESTIMATES.

As the Division Engineer of the Southwest Division has expressed the opinion that this part of the river is not worthy of improvement, and as this view has received the approval of the Chief of Engineers, it is recommended that work on this part of the river be abandoned. Therefore no estimate for further appropriation is submitted.

Money statement.

July 1, 1893, balance unexpended	$2,240.39
June 30, 1894, amount expended during fiscal year	2,145.72
July 1, 1894, balance unexpended	94.67

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics upon this improvement, but as yet no success has been met with.

During the fiscal year ending June 30, 1893, freight was carried on this portion of the river to the amount of 4,873 tons, the estimated value of which was $1,200,000.

P 5.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of examinations and surveys of the river, printed in the Annual Reports of the Chief of Engineers for 1872, p. 588, and 1889, p. 1423.

The project provides for obtaining a low-water navigable channel from the mouth of the river to Newton, Ala., an estimated distance of 162 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by excavating rock shoals and by deepening sand bars by works of contraction and shore protection.

At Caryville, Fla., 100 miles above its mouth, the river is crossed by the Pensacola and Atlantic Railroad.

The country along the river below Caryville is sparsely settled, and the business consists almost exclusively in the cutting and rafting of lumber. This portion of the river is so little used for commercial purposes that no work has been done on it for several years past.

Geneva, Ala., 25 miles above Caryville, is a thriving town and is the trading and shipping point for a rich agricultural region surrounding it, which is rapidly increasing in population, and which is dependent upon the river for the transportation of its products and supplies. Nearly all the commerce of the river is carried on between Geneva and Caryville, the nearest railroad point. Consequently, during recent years, the improvement has been confined mainly to this section of the river. The channel has been pretty well cleared of the accumulation of snags and logs which formerly obstructed it, but low-water navigation is still impeded by several sand bars.

During the low-water season of 1892 the deepening of these bars by works of contraction and shore protection was begun, and it is proposed to continue this work as funds are available.

Between Geneva and Hollis Bridge, 30 miles above, the river is obstructed by snags and sunken logs and occasionally by sand bars.

The obstructions have from time to time been partially cleared out between Geneva and Pate Landing, 25 miles above, and when freight is offered steamboats run to Pate Landing at favorable stages of water.

Between Hollis bridge and Newton, 7 miles above, low-water navigation is prevented by a series of nine shoals, formed by strata of very compact blue clay. Since the completion of the Alabama Midland Railroad from Montgomery, Ala., to Bainbridge, Ga., which passes through Newton, the urgent necessity for the improvement of this section of the river no longer exists.

It is doubtful if this section of the river would now be much used even if the projected improvements, which contemplated excavating channels through the shoals and confining the water thereto by training dams, were completed. From experience with similar work on other rivers, it is also doubtful whether this method of improvement will provide for satisfactory navigation at low water, and it is probable that this can only be secured by a system of slack-water navigation by locks and dams, at a cost not warranted by any prospective benefit to be derived therefrom. Unless otherwise directed, it is, therefore, not proposed to do any work on the river above Pate Landing until the section between this point and Caryville has been put in good navigable condition for all stages of water.

After this is accomplished the annual cost of maintaining the snag boat for the removal of logs and snags brought in by the winter freshets, and for keeping the contraction and shore-protection works in repair, is estimated at $6,000.

APPROPRIATIONS.

March 3, 1833	$5,000
June 15, 1844, for Choctawhatchee and Holmes rivers	10,000
June 25, 1874	5,000
March 3, 1875	5,000
August 4, 1876	5,000
March 3, 1879	5,000
June 14, 1880	7,000
March 3, 1881	$10,000
August 2, 1882	18,000
July 5, 1884	15,000
August 5, 1886	15,000
August 11, 1888	10,000
September 19, 1890	12,500
July 13, 1892	12,500
Total (since 1874)	120,000

OPERATIONS TO JUNE 30, 1893.

Operations were confined almost exclusively to the removal of the great accumulation of logs and snags from the channel and overhanging trees from the banks, and to providing and maintaining the necessary plant for this work.

The section of the river between its mouth and Caryville having been sufficiently improved to accommodate the small commerce thereon, the work during recent years has been mainly carried on between Caryville and Geneva, but some work has also been done between Geneva and Pate Landing.

The improvement accomplished, although incomplete, has resulted in great benefit to navigation. Steamboats now run at all stages of water between Geneva and Caryville, but at low water full loads can not be carried, and they are much delayed by sand bars, which can be readily deepened if sufficiently large appropriation be made for the work.

At the close of the fiscal year ending June 30, 1893, the river was in a navigable condition for boats and rafts at low water between the towns of Geneva, Ala., and Caryville, Fla. The three most troublesome shoals, viz, Buzzard Bar, Gumfield, and Busby Shoals, had been improved during the year of 1893, and boats have since experienced no trouble in passing over them.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer J. E. Turtle, who has been in local charge of this work, reports:

> The work required to be done on this stream consists largely in maintenance, the removal of snags and sunken logs from the channel, the deepening of the water over several bars by contraction works, and the protection of banks against caving; to this end the work performed during the fiscal year of 1894 was directed.
>
> At the beginning of the fiscal year of 1894 the snag boat *Choctawhatchee* was at work removing obstructions from the channel, it being intended to do this in a most thorough manner. So soon as this was done, the snag boat was to assist the pile-driver in carrying on contraction and bank protection work. The snagging work was delayed considerably by high water, and was not completed until November 29. Snagging was suspended on this date, and the shore protection, one-half mile above Caryville, was begun. This protection, 264 feet long, was made of a single row of piles well wattled with poles. It was completed January 8. The snag boat was then sent up the river for the pile-driving plant. The whole was taken to Caryville, the property stored, and the crews disbanded on January 17.

WORK PERFORMED BY PILE-DRIVER.

> The water having reached a good stage for contraction work on July 5, a party were put at work at the Cut-off, piles previously having been placed on the bank near the site of the proposed work. The trouble at the Cut-off, which was rapidly growing worse, was due to the washing away of the head of the island formed by

the Cut-off, which permitted the rapid growth of a bar on the opposite side of the stream, the bar keeping pace with the erosion of the island. The high water of 1893–'94 made this place very troublesome for boats at moderately high stages of water, the rapid currents tending to force them into Old River as they turned to make the bend. A map of the Cut-off is submitted herewith. The work done at this point was the construction of a dam 265 feet long across the mouth of Old River. The dam is made of a double row of piles, 6 feet apart. Each row is well wattled, and the space between the rows is filled with brush, which is held in place with cross poles securely spiked. The outer row of piles is extended up and down stream, beyond the inner row, a total distance of 115 feet. This extension forms a shore protection for the bank of the river, which is liable to erosion. A rise of some 6 feet occurred just before the work was finished. When the water again reached a low stage the bar which had been forcing the channel back into Old River had entirely disappeared, the deep water being likewise forced to the right bank.

Harveston Whirl.—Next to the shoals improved in 1893 this was the most troublesome place during low water. The work of improving it, begun in the latter part of September, contemplated deepening the water on two bars and protecting the bank, as shown on map herewith submitted. The works for the improvement of the upper bar consisted of a transverse dam 160 feet in length, connecting with a longitudinal dam 480 feet in length. The transverse dam was made of a double row of piles, the longitudinal one of a single row, all well wattled. The work for the improvement of the lower bar consisted of three transverse dams, the upper one 175 feet in length, of a double row of piles, the lower ones 160 and 152 feet, respectively, each of a single row, and of a bank protection 850 feet in length. Several hundred feet below this shoal, where the river makes a short turn to the right, the bank was caving rapidly on the left, the tendency being to reach Blue Slough. (See sheet No. 1, herewith submitted.) To arrest this and to force the bar back, a longitudinal shore protection 580 feet in length was built of a type similar to the longitudinal dams constructed on this river. The piles were driven at the foot of the slope, and then carefully wattled with poles. In this case a spur 40 feet long was placed at the upstream end of this shore protection to deflect the current against the bar on the opposite side. This work was completed early in January, when owing to the approach of high water the plant was taken to Caryville, where the crew was disbanded on January 17.

A survey of the shoals improved during the present fiscal year was made in the early part of June, 1894. A map showing comparative cross sections is submitted herewith.

The shore protection put in one-half mile above Caryville has arrested the caving at this point. It is in good condition. The shore protection and longitudinal dam constructed at the Cut-off has brought about most satisfactory results, removing entirely to a plane below low water the bar which was forming on the left side under the point, and arresting the erosion of the island. Naturally, Old River is filling up. During the winter several rafts caught on this dam, remaining there while the water was falling. This injured the work slightly. It should be repaired during the coming season. To do this will require the work of eight men for six days. At Harveston Whirl the upper transverse and longitudinal dam has deepened materially the water on the upper bar. The contraction works at the lower bar have not produced as much scour as was hoped. The height above low water to which these works were carried was such as to have the greatest amount of scour done during the lower stages of water. As the examination referred to was made immediately after the water had fallen rapidly from a high stage, and as it had been high for four and a half months, I feel that the low-water currents will do very soon all that will be required. In the shoalest places the sand was very soft, and appeared to be moving. At this place too much contraction would be quite injurious, as it would increase greatly the amount of scour that would have to be accomplished by the upper dams. Therefore, care was taken to avoid this. The amount of shoaling below and behind the dams is very marked.

During the spring a log jam of several thousand logs caught on the upper dam and made a break about 75 feet long in the longitudinal part before it was removed. This should be repaired during the coming season. Since a bar has formed behind this dam no immediate bad results are liable to occur from this injury. To make these repairs would require the work of 8 men for five days. Some time during the winter logs and rafts injured the middle of the lower transverse dams, but as a bar has formed above and below this dam no repairs are required. The long shore protection opposite these transverse dams is in good condition. The shore protection below these shoals has arrested the caving of the bank; the bar on the opposite side has receded.

The contraction works constructed in 1893 are in good condition, giving on the shoals where they were placed as much water as the commerce of the river demands.

Work performed was as follows:

Removal of obstructions:	
Snags removed from the channel	1,167
Logs removed from the channel	249
Overhanging trees felled and cut up	55
Logs on bank cut up	100
Trees pulled back	210
Rock removed from channel, cubic yards	17
At a total cost of	$2,930.60
Contraction and bank-protection works:	
Length of dams, including shore protection, linear feet	3,261
At a total cost of	$3,813.50
Or cost, per running foot of	1.17

Above figures include superintendence, labor, and material.

CONDITION OF IMPROVEMENT JUNE 30, 1894.

The work accomplished during the fiscal year ending June 30, 1894, has made safer the passage of boats during low water. Boats now run day and night whenever necessary, and this while carrying large loads of freight.

The work done in 1893 maintains a good low-water depth over three of the most troublesome bars; the work done in the fiscal year now ending has improved two more, making five, which I think will give no further trouble.

RECOMMENDATIONS AND ESTIMATES.

With liberal appropriations for a few years the section of river between Caryville and Pate Landing, upon which the neighboring country is dependent for transportation facilities, can be placed in good navigable condition at all stages of water, and thereafter the cost of maintenance will not exceed $6,000 per year.

Considerations of economy, as well as the commercial importance of the river, make it desirable that the projected improvements should be completed as soon as practicable.

Mr. Turtle makes the following recommendation and estimate, in which I concur fully:

> It is recommended that during the next fiscal year, should money be available, contraction works be continued whenever the stage of water will admit, and when it has fallen to a good snagging stage that all necessary obstructions be removed from the channel, and, when this is accomplished, that all the plant be put on contraction and bank-protection work. In this manner work can be carried on by both parties whenever the water is below 5 feet. Thirty thousand dollars in this way can be profitably expended during the fiscal year ending June 30, 1896.
>
> Before the snag boat is again put at work she should be put on the ways and thoroughly repaired.

Money statement.

July 1, 1893, balance unexpended	$10,239.06
June 30, 1894, amount expended during fiscal year	8,175.12
July 1, 1894, balance unexpended	2,063.94
July 1, 1894, outstanding liabilities	140.70
July 1, 1894, balance available	1,923.24
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	30,000.00

COMMERCIAL STATISTICS.

Capts. J. D. Jenkins, A. F. Tatom, and G. A. Hinson, of Geneva, Ala., report the following commercial statistics for the year ending June 30, 1894:

Stern-wheel steamboat.	Registered tonnage.	Draft of water.		Round trips between Geneva, Ala., and Caryville, Fla.	Passengers.
		Light.	Loaded.		
		Inches.	*Inches.*		
Joe Davis	95.44	15	32	113	836
Mary Alice	34	15	40	155	615
Annett	102.05	17	40	52	85

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	10,130	2,532
Cotton-seed meal	sacks	800	40
Fertilizers	do	36,302	3,630
Hides	packages	8	1
Lumber	feet, B. M.	53,113	180
Grain	sacks	22,885	1,368
Salt	do	2,380	238
Lime	barrels	700	70
Shingles			14,250
Wagons			75
Stoves			65
Miscellaneous freight			5,910
Total			28,359

Estimated value of above in round numbers	$2,000,000
Estimated value of lumber trade on river	800,000

The steamer *Annett* was built during the past winter, making three boats now plying this river.

P 6.

IMPROVEMENT OF HARBOR AT PENSACOLA, FLORIDA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendations contained in the report of the Board of Engineers for Fortifications and for river and harbor improvements, dated February 12, 1881, and printed in the Annual Report of the Chief of Engineers for 1881, p. 1177.

The project provided for dredging a channel 300 feet wide and 24 feet deep at mean low water across the inner bar, for the temporary relief of navigation and for protecting the shore line near Fort McRee from further abrasion by the construction of jetties and works of shore protection, with the view to preventing further injurious changes in the tidal currents, and also of retaining the position for defensive purposes.

At that time the least low-water depth on the inner bar was 19.5 feet. Between 1881 and 1886 the inner-bar channel was dredged at various times, and in the latter year it was reported that a channel 120 feet wide and 24 feet deep had been obtained.

The further injurious abrasion of the shore line near Fort McRee was stopped by the construction of two groins of stone and concrete blocks nearly at right angles to the shore line. The groins were completed in April, 1890.

In the spring of 1890 another survey of the entrance to the harbor was made, which showed that the channel across the inner bar had shoaled since 1886 from the reported depth of 24 feet to a least depth of 19.6 feet. On January 17, 1891, the report of this survey was referred to a Board of Engineers appointed to assemble at Pensacola, Fla., to consider and report upon improvements of the harbor. The report of this board is dated July 16, 1891, and is printed in the Annual Report of the Chief of Engineers for 1891, p. 1723.

The plan of improvement recommended by the Board, with the reasons therefor, is sufficiently indicated in the following extracts from their report:

> 6. *Character of bar and changes.*—The depth of water on the outer bar since the time of authentic surveys has remained constant at about 22 feet. Previous to the dredging done in accordance with the project of 1881 there was a depth of 19.5 feet across the inner bar. This was increased in 1886 to 24 feet, with a width of 120 feet. The growth of the Middle Ground has caused shoaling to take place in that channel until there remains at present a low-water depth of 19.6 feet, which is practically that which existed prior to improvement. The depth of water on the three principal shoals has not changed.
>
> 7. *Commerce.*—The commerce of Pensacola for the calendar year 1890 amounted to about $5,000,000, the principal exports consisting of cotton, naval stores, timber, and lumber, and the imports of fruit and fertilizers.
>
> Over 300,000,000 feet of timber and lumber were shipped during the year.
>
> Pensacola's foreign sailing tonnage exceeds that of all the other gulf ports combined, including New Orleans.
>
> Col. W. D. Chipley, vice-president of the Pensacola and Atlantic Railway Company, in reports appended hereto, states that a movement is now fairly started through which Pensacola will export, in addition to the cotton, naval stores, and timber mentioned, coal, iron from the mines of Alabama, railroad, bridge, car, house, and ship building material, etc. He further states that Pensacola is beginning to send cotton goods, machinery, and Western produce of every kind to the Americas south of us, which shipments, he adds, will be largely increased under the policy of reciprocity.
>
> After the deepening of the inner bar in 1881-1886 the commerce of the port was largely augmented, and the class of vessels entering the harbor much improved. Shoaling has since taken place, and during the past year vessels have been detained after loading from one to five weeks before being able to go to sea. A number of vessels went aground on the inner bar, while a large number were obliged to put to sea with incomplete cargoes. Owing to the increased commerce of the port the necessity for deep water is greater than before the first improvement was made. It is estimated that a reduction of from 8 to 20 per cent in freight rates would follow an increase of the navigable depth to 26 feet.
>
> It will be seen that Pensacola has better natural conditions for deep water than any other gulf port. Existing railroads are extending their lines, and new roads, projected or in process of construction, will afford ample facilities for communication with the interior. The importance of Pensacola from a military and naval standpoint has long been recognized, and considerations of defense, as well as those governed by commercial necessities, demand the improvement of the entrance to its harbor.
>
> 8. *Plan of improvement.*—The method of obtaining deep water across the bar at the entrance to Pensacola Harbor by dredging was tried between 1881 and 1886, there having been obtained in the latter year a channel 120 feet in width and 24 feet in depth.
>
> Although only five years have elapsed since then, the growth of the Middle Ground and Caucus shoals has been so rapid that the depth of water in bar channel has already been reduced to that prevailing prior to the original improvement.
>
> To obtain over the inner and outer bars, by dredging, a channel 24 feet deep and 300 feet wide will cost, in round numbers, $190,000, and will require an annual expenditure of $30,000 thereafter for its maintenance.
>
> A more permanent channel would doubtless be one in the direction of the ebb flow across the outer end of Caucus Shoal; but to obtain this by dredging would cost, in round numbers, $357,000, and its self-maintenance without jetties to insure tidal scour and to protect the channel from the inflow of sand is doubtful.

There remains, then, the method of improvement by jetties, aided, if necessary, by dredging.

The further eastward advance of Caucus Shoal and southward advance of the Middle Ground Shoal should be arrested, and the ebb and flood flow should be united and trained across the bar in a favorable direction.

The location of the western jetty is fixed by the shore line, the present channel, and the direction of the tidal flow across the bar. It now becomes necessary to so locate the eastern jetty as not only to arrest the westward travel of sand along the beach of Santa Rosa Island, but to obtain in the jetty channel the greatest tidal scour practicable without injury to the jetties themselves or to the present favorable tidal status of the bay.

9. *Description of jetties and order of construction.*—It is proposed to build the shore arm of the western jetty up to high water; from the shoulder point 5,000 feet from the shore end of the jetty the crest should be brought up to the mean height of the beginning of ebb outflow; for the next 4,300 feet the crest should be brought up to mean low water, from which point it will sink to the foundation course.

The shore arm of the eastern jetty should be built up to high water; the crest of the jetty will then sink within a distance of 1,200 feet to the level of the foundation course.

It is proposed to construct the jetties with a foundation course of brush mattresses 100 feet in width, and a superstructure of rubble stone capped with concrete.

The estimated cost of the improvement, which, in round numbers, is $1,830,000, supposes that money is regularly and adequately supplied. Without this the cost of the work will be largely increased and its success rendered doubtful.

Under date of August 3, 1891, the report of the Board was referred to the Division Engineer, Southwest Division, for remark. His indorsement was as follows:

Respectfully returned to the Chief of Engineers.

The estimated cost of obtaining 24 feet of water by dredging is $190,000, and its annual maintenance is estimated at $30,000.

The estimated cost of the proposed low jetties is $1,800,000, while the final cost will probably be considerably greater. At 3 per cent the annual interest on $1,800,000 would be $54,900, much exceeding the estimated cost of maintenance of a dredged channel.

In view of these figures, and of the success thus far obtained in the maintenance of the Sandy Hook Channel, I think that the improvement should be continued by dredging, until it is found that $50,000 a year will not maintain a channel after it is once completed.

On November 12, 1891, the Board submitted a supplementary report, in which it is stated:

Inasmuch as the plan of improvement recommended by the Board contemplates an expenditure of $1,830,000, the annual interest on which at 3 per cent ($54,900), exceeds the estimated annual cost of maintenance of the dredged channel, the Board desires to set forth more fully the reasons which compelled the rejection of the plan of improvement by dredging alone, and the substitution of the plan of improvement by jetties.

That a dredged channel across the inner and outer bars at Pensacola will not be self-maintaining has been demonstrated by experience. So few surveys of the bar have, however, been made that it is not possible to determine the rate at which the shoaling has taken place, and therefore, for the purpose of estimating the cost of maintaining a dredged channel, the rate of shoaling as shown by a comparison of the surveys of 1886 and 1890 was assumed. It is probable, however, that the volume of sand moving in the ship channel during that period was many times that determined by the method outlined. On the South Atlantic Coast, at Cumberland Sound, where the bar is composed of material somewhat similar to that at Pensacola, storms of a few days' duration have caused a shoaling of 3 feet and more in the ship channel, while at other times storms of equally short duration have produced as great a scour. It is possible that as great and sudden changes have taken place at Pensacola.

On ocean bars composed of coarse sand or gravel, dredging alone has, in some instances, proven successful, but on the bar at Pensacola, composed of very fine sand, easily placed and held in suspension, no such satisfactory results can be expected. An unjettied channel is, moreover, liable to be blockaded in a few days, or perhaps in a few hours, by a heavy storm, while rough weather might prevent dredges from affording relief. If the port of Pensacola is to offer adequate facilities to its shipping, it is imperative that the depth of water on the bar shall not be liable to sudden fluctuations, and the great advantages which would accrue to the shipping by having a permanent and straight channel of probably a greater depth than 24 feet, instead of the present crooked channel with a probable depth during a considerable part of the year of much less than 24 feet, make it necessary that the plan of improvement by jetties should be adopted, and the Board can not, therefore, recommend a plan of improvement which has already proved a failure, which can at best give only temporary relief, and which may permit the blockade of the harbor during the busiest season of the year, and thus greatly and unnecessarily retard the development of the port and seriously injure its commerce.

A careful examination of the inner bar, made in November, 1892, showed that there had been not only a slight decrease in the least mean low-water depth, viz, from 19.6 feet to 19.2 feet, but that there had also been a continued growth of the Middle Ground to the southward, and a consequent narrowing of the channel. In 1881 the distance between the 18-foot curves on the Middle Ground and Caucus Shoal, i. e., the width of the 18-foot channel across the inner bar, was 2,740 feet. In November, 1892, this distance had been reduced to 840 feet, and the 18-foot curve on the Middle Ground had moved 1,440 feet to the south. In 1887 the least depth on the inner bar on the range of the two beacon lights was about 22 feet. In November, 1892, the least depth on that range was 17.7 feet, and the best channel across the inner bar, with a least depth of 19.2 feet, was between the first and third ranges south of the beacon range, i. e., between 75 and 225 feet south of the lighted channel. These facts appear to indicate that the 24-foot channel (of which the north edge is on the beacon range), now being dredged across the inner bar under the appropriation of July 13, 1892, will be soon be filled up again by the continued growth of the Middle Ground to the south.

APPROPRIATIONS.

June 18, 1878	$20,000	August 5, 1885	$20,000
March 3, 1879	10,000	August 11, 1888	35,000
June 14, 1880	40,000	September 19, 1890	25,000
March 3, 1881	20,000	July 13, 1892	75,000
August 2, 1882	50,000		
July 5, 1884	55,000	Total	350,000

OPERATIONS TO JUNE 30, 1893.

Work has been carried on when funds have been available since 1879. In 1879-'80 the wrecks obstructing the channel were removed. In April, 1890, 2 stone and concrete groins, for preventing further abrasion of the shore line at Fort McRee, were completed, and have so far accomplished the purpose for which they were built. Dredging was done at various times between 1881 and 1886, at which time a channel 120 feet wide and 24 feet deep across the inner bar was reported. In June, 1891, the suction dredge *Bayley*, belonging to the Mississippi River Jetty Company, was hired for a short time to remove certain lumps which had appeared in the channel across the Inner Bar, and were causing serious delays in the departure of loaded vessels.

The advance of the Middle Ground to the southward had become so great that the channel depth had not only shoaled to that of 1879, when the improvement of this harbor was first contemplated, but the width on the Inner Bar also was greatly reduced.

The contract with Rittenhouse Moore, October 29, 1892, was extended to May 1, 1893. Moore did not begin work until June 7. Only 27,852.37 cubic yards of material were removed up to June 30, at which time the channel depths were practically the same as when the improvement of this harbor was begun. Vessels drawing 21 feet required a good tide in order to be able to pass the bar.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer J. E. Turtle, who has been in local charge of the work since 1887, reports as follows:

Work under Moore's contract was continued night and day, under the most favorable conditions of weather, until August 15, when the condition of the funds made necessary a suspension of operations.

The dredging was confined to an area marked by the McRee beacons on the north and by the third range on the south. This gave a channel width of 225 feet; the dredging was limited east and west by the 24-foot curves, these being about 1,400 feet apart.

Two days after the completion of dredging under this contract a survey of the inner bar was made, the condition of the water being most favorable. These soundings were plotted, and a map showing longitudinal sections of the inner bar channel submitted. These soundings indicated that the dredging was not carried as far north as the beacons, and that it extended to the fourth range south. For instance, the soundings which were taken on the beacon range were taken with the beacons open, an apparent distance of 4 feet; this places the foot of the North Slope 45 feet south of the beacons. The dredging was carried south of the third range an equal distance, making the channel under this contract 225 feet in width. The channel was placed as above, first, to avoid as far as possible the Middle Ground; second, to place the dredging where it would give the best result, and third, to retain the beacons as a guide for pilots. The amount of dredging done as far south as the fourth range was very small, it being occasioned no doubt by the drifting of the dredge.

An examination of the longitudinal sections above referred to will show that 24 feet of water at mean low water was secured.

The following figures of the cost were obtained:

Amount of material dredged, in cubic yards	92,505.17
Cost per cubic yard, as per contract	$0.63
Cost per cubic yard for inspection	.0107
Total cost per cubic yard	.6407

The total amount of dredging done under this contract was 120,357.54 cubic yards. Actual time of pumping, 452 hours 8 minutes; rate per minute in cubic yards, 4.43; time lost in turning and dumping, 274 hours 47 minutes; time lost through other causes, 343 hours 53 minutes.

The dredge employed was supplied with three 10-inch suction pumps, discharging into vats, each of which contained about 100 cubic yards. The discharge and vats were poorly arranged, and much material was lost to the contractor in the overflow. The dredge had no motive power of its own, but was towed by tugs. As the dredge had to work constantly across the currents, 2 tugs were frequently required, and even then much time was lost by the dredge drifting out of the channel.

CONDITION OF IMPROVEMENT JUNE 30, 1894.

A survey of the inner bar was made during the latter part of June. It was completed on June 30, with the conditions very favorable. The following least depths were found:

	Feet.
On a range 45 feet south of the beacons	19.5
On the first range south	21.5
On the second range south	21.5
On the third range south	21.5

These ranges are 75 feet apart.

The depths found in the same localities, determined by comparison of transit readings after the completion of the above contract, were

On the range 45 feet south of beacons	24.4 feet,	a shoaling of 4.9 feet.
On the first range south	25.5 feet,	a shoaling of 4 feet.
On the second range south	23.6 feet,	a shoaling of 2.1 feet.
On the third range south	24.3 feet,	a shoaling of 2.8 feet.

These soundings are being plotted, and when submitted on a comparative map the shoaling over the entire bar can be readily seen, and will no doubt extend over the entire area dredged.

The shoaling indicated by the above figures occurred in ten and one-half months, and there is no doubt that within a year from now the benefits derived from dredging under the last contract will have disappeared entirely.

A slight shoaling has also occurred on the outer bar, there being less than 22 feet at mean low water.

Mr. Turtle remarks on the work of the past fiscal year as follows:

> No matter upon what lines the improvement of this harbor is to be continued, it is evident that the entrance of the port must be maintained by dredging for several years to come. If this improvement be continued upon the old plan, which simply calls for dredging, dredging should be done within the next fiscal year; if the plan of the recent board be adopted, dredging in the proposed channel under this plan should be commenced as soon as possible, in order that this new channel may give relief to commerce before the present one is again closed. To bring about these results in a satisfactory manner some provision should be made to have the work carried on economically. Several attempts have been made to dredge on this bar under the contract system. I think they all have proved unsatisfactory; they have all been certainly expensive.
>
> Take, for instance, the last contract; the cost to the United States per cubic yard was $0.6407. The cost to the contractor per cubic yard, including the cost of his dredge (which, according to the builders' statements was $27,000) was $0.3656. The cost to the contractor without the dredge was $0.1412; contractor's profit per cubic yard was $0.4888. Contractor's running expenses for three months, $17,992.50; cost of dredge, $27,000; total expense of work to contractor, $44,992.50. Amount paid to the contractor, $75,825, leaving a profit after paying for dredge of $30,832.50; or a profit, including first cost of dredge, of $57,832.50. Time of pumping was 452 hours; profit to contractor for every hour actual pumping, $127.90.
>
> The above figures were carefully obtained while the dredge was at work and very closely represent the facts in the case. Evidently they go to prove that a great saving would accrue to the United States by owning its own plant if extensive operations are to be carried on at this point.

It may be well to analyze somewhat differently the figures presented by Mr. Turtle.

The total quantity of sand pumped was 120,357.54 cubic yards; the time spent in pumping was 452 hours and 8 minutes; hence the hourly result was 266.20 cubic yards. This result shows the incapacity of the plant.

The time lost in going to and from the dumping ground, including the time of dumping, was 274 hours and 47 minutes; hence the hourly dumping result was 438.04 cubic yards. This result shows the unwieldiness of the plant.

Out of the 1,070.71 hours during which the vessel's movements were reported, 343.88 hours were spent on repairs; in other words, 32 per cent, nearly one-third, of the time was spent in repairs. Considering that the work was done "under the most favorable conditions of weather," this loss of time is astonishing. To be sure Mr. Turtle reports (see Annual Report Chief of Engineers for 1893, p. 1714) that up to June 30, 1893, 206 hours had been lost, of which a great part "was consumed in actually completing the dredge after work had commenced." Supposing that all of the time lost up to June 30, 1893, had been spent in finishing the dredge, there would still remain 137.88 hours for repairs; in other words, nearly 13 per cent of the time, still a large percentage of loss for a new vessel in a little more than two months. It is evidence of the inferior character of the plant.

Past records show that the dredge was entirely new, and that the work at Pensacola was the first on which it was used. The deterioration of the plant during the two months of work may be disregarded. The contractor had on hand at the end of the work a new dredge worth $27,000.

The amount paid to the contractor was $75,825, of which $17,992.50 represents his expenses. His profits, including the new dredge, are

$57,832.50, or 324.25 per cent of what the work cost him, a percentage of profit which is certainly out of all reason.

The cost of the new dredge being $27,000, the contractor's profit was sufficient to provide his plant twice over and still to leave him $3,823.50.

Judging by the cost of dredging at New York, on the Tyne and Clyde, and at Dunkirk, France, there is no doubt that the dredging on the bar at Pensacola can be done for 6 cents a cubic yard if the Government owns its own dredge.

RECOMMENDATIONS AND ESTIMATES.

The harbor of Pensacola is the best on the gulf coast. Its entrance is obstructed by a bar of no great width. From the 30-foot curve inside the bar to the same curve outside the bar is only a mile and seven-eighths. A part of the channel lies, at present, nearly at right angles to the direction of the ebb-tide currents. The result is that whenever dredging is done along the line of the channel the cut is filled up again very soon.

It is recommended that a new channel be dredged across the Caucus Shoal. It is further recommended that the Government have built for service at this harbor a suitable suction dredge, with a bin capacity of about 500 cubic yards, and of power sufficient to fill the bins in forty minutes at the outside. In case of sufficient appropriations being made it is also recommended to begin the accumulation of materials and of a plant for the construction of the east jetty, as recommended by the Board of Engineers of 1891.

An appropriation of at least $500,000 can be expended judiciously on these objects during the year ending June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$83,293.85
June 30, 1894, amount expended during fiscal year	80,770.53
July 1, 1894, balance unexpended	2,523.32
July 1, 1894, outstanding liabilities	70.48
July 1, 1894, balance available	2,452.84
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	500,000.00

COMMERCIAL STATISTICS.

Value of exports to foreign ports	$4,025,637.00
Value of exports to coastwise ports	397,545.00
Total	4,423,182.00
Value of imports from foreign ports	225,313.20
Duties on imports and miscellaneous collections	22,647.00
Vessels entering from foreign ports	439
Vessels entering from coastwise ports	162
Total	601
Vessels clearing for foreign ports	432
Vessels clearing for coastwise ports	152
Total	584
Vessels employed in the traffic of the port	210

P 7.

IMPROVEMENT OF ESCAMBIA AND CONECUH RIVERS, FLORIDA AND ALABAMA.

PLAN OF IMPROVEMENT.

The Escambia and Conecuh rivers are actually one river, that portion of the river from its head waters in southeastern Alabama to the Florida and Alabama State line being called the Conecuh River, and the portion in Florida, 61 miles long, being called the Escambia River. It empties into Escambia Bay, an indentation from Pensacola Bay. Fully 66 per cent of the immense quantity of timber shipped from Pensacola Harbor is cut on lands tributary to the Escambia River, and is floated down in rafts to Pensacola Harbor.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of the examinations and surveys of the rivers, printed in the Annual Report of the Chief of Engineers for 1879, pp. 843–852.

The project provides for the improvement of the river from its mouth to Indian Creek, in Alabama, an estimated distance of 293 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by excavating rock shoals, by deepening sand bars, by works of contraction and shore protection, and by dredging a channel through the bar at the mouth of the river.

The object of the improvement is to facilitate the movement of saw logs and timber rafts down the river, and to afford at the same time a suitable channel for steamboat navigation. The value of the lumber annually transported on the river is estimated at $1,800,000.

In order that the rafting business may be carried on safely and profitably, it is necessary that the river should be kept fairly free from logs and snags. This requires the maintenance of an efficient snag boat, at an estimated cost of $6,000 per annum.

In the fall of 1889 a channel 60 feet wide and 6 feet deep was dredged through the bar at the mouth of the river by means of a centrifugal pump, mounted on the snag boat. This channel has since shoaled to 4 feet, and it is very desirable that a sufficient amount should be appropriated to enable a cut 100 feet wide and 8.5 feet deep to be made.

The harbor tugs can not now cross the bar and enter the river to reach the rafts and tow them to Pensacola. The rafts are floated down over the bar and fastened to timber stands in the bay, where they are exposed to sudden storms. A large annual loss of lumber and money is thus occasioned.

APPROPRIATIONS.

For Escambia River:	
March 2, 1833	$5,000
July 2, 1836	5,500
June 14, 1880	8,000
March 3, 1881	5,000
July 5, 1884	3,000
August 2, 1882	12,000

For Escambia and Conecuh rivers:	
July 5, 1884	$12,000
August 5, 1886	12,000
August 11, 1888	10,000
September 19, 1890	7,500
July 13, 1892	8,000
Total	88,000

OPERATIONS TO JUNE 30, 1893.

The appropriations had been expended in providing, maintaining, and renewing the necessary working plant and in removing the obstructions from the channel and overhanging trees from the banks from the mouth of the river to Jordan Shoals, a distance of 136 miles; in keeping the channel fairly free from logs and snags brought in by the winter freshets, and in twice dredging a channel through the bar at the mouth of the river to permit the passage of towboats drawing 5 feet of water.

CONDITION OF IMPROVEMENT JUNE 30, 1893.

At the close of the fiscal year 1893 the river was in a condition to admit of the safe passage of rafts on stages of water above 2 feet, and for a distance of 106 miles from the mouth.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer J. E. Turtle, who has been in local charge of the work, reports:

The portion of the river between Brewton and Molino, called the middle river, runs through alluvial soil and is tortuous. Many snags are brought in by the annual freshets. The object of the work of 1894 was to improve this portion of the river.

At the beginning of the fiscal year ending June 30, 1894, a party were at work removing obstructions from the channel in accordance with the approved project. The funds being low, the snag boat *Escambia* was started downstream from Old River, near Brewton, Ala., intending to make a trip as far as Molino, Fla., removing the worst of the obstructions, and then to return to Old River. Work under this plan was continued until September 11, when, owing to the condition of funds, it was suspended and the plant tied up. The length of the river worked over was 71 miles.

Snags removed from the channel	367
Logs removed from the channel	8
Overhanging trees felled and cut up	71
Logs on bank cut up	122
Stumps removed level	47
At a total cost of	$1,078.35

The work accomplished during the fiscal year ending June 30, 1894, made safer the passage of rafts during the low stages of 1893 and 1894.

While these operations have greatly improved the river for the transportation of rafts, they are not permanent, and work will have to be done on the river every year in order to keep it in its present condition.

RECOMMENDATIONS AND ESTIMATES.

I concur in the following recommendations and estimates of Assistant Engineer J. E. Turtle:

As stated in my annual report for 1892, the commerce of this stream is, and probably will for some time continue to be, restricted to the transportation of lumber, and its improvement should be governed accordingly; consequently, in connection with the removal of obstructions from the river, a channel should be dredged through the bar at the mouth. This channel should be deep enough to permit the tugs which tow the rafts to pass up to Ferry Pass, 1 mile above the mouth. The rafts are now dropped out of the river into the bay; this is frequently dangerous and much loss is occasioned by it. The bar was dredged several years ago, with a very limited amount of funds, and a narrow channel, having a depth of 6 feet, was secured. The channel has now shoaled to 4 feet. If the operations on this stream are to be carried on in the interests of the lumber export trade of Pensacola, the deepening of the bar at the mouth is important, and will be of great benefit to the commercial interest of the port.

The deepening of this bar is the most important work now to be done. Experience has shown that the material of which it is composed can be removed readily with a sand pump. The channel through it should admit of towboats going into the river for tows of timber, which have now to be floated into the bay. The depth of the channel should be 8.5 feet, and its width should be at least 100 feet. The sides should be outlined with piles. This would enable boats to pass out quickly during all stages of tides and conditions of weather, and add to the permanency of the work.

I would respectfully recommend that $12,000 be appropriated for the deepening of this bar and $12,000 for continuing improvement on the river. These sums can be profitably expended during fiscal year ending June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$2,688.91
June 30, 1894, amount expended during fiscal year	2,403.83
July 1, 1894, balance unexpended	285.08
July 1, 1894, outstanding liabilities	81.44
July 1, 1894, balance available	203.64
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	24,000.00

COMMERCIAL STATISTICS.

The present commerce of this stream is confined to the rafting of timber and logs. Not less than 66 per cent of the lumber exported from the port of Pensacola passes out of this river, the estimated value of which is $2,800,000. No accurate records of the timber business on the river are obtainable, and more detailed statistics can not be furnished.

P 8.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of examinations and partial surveys printed in the Annual Reports of the Chief of Engineers for 1876, p. 498, and for 1891, p. 1761.

The project provides for obtaining a low-water channel 6 feet deep from Wetumpka, Ala., to the junction with the Tombigbee River, 44 miles above Mobile, Ala., an estimated distance of 323 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by removing rock reefs and gravel bars by blasting and dredging, and deepening sand bars by works of contraction and shore protection, at an estimated cost (prior to the appropriation of July 13, 1892, of $70,000) of $386,251, exclusive of the cost of maintenance and snagging, estimated at $10,000 per year.

The normal width of the upper portion of the river is from 500 to 600 feet, and of the lower portion from 700 to 800 feet. Where the river has the normal width the low-water depths in the channel vary from 8 to 15 feet; but where these widths have been increased by the erosion of the banks, shoals, bars, or reefs are found. The average slope of the low-water surface is about 4 inches per mile. The maintenance of an efficient stern-wheel snag boat is required to remove logs and snags brought in by the winter freshets each year.

APPROPRIATIONS.

June 18, 1878	$25,000	August 5, 1886	$15,000
March 3, 1879	30,000	August 11, 1888	20,000
June 14, 1880	25,000	September 19, 1890	20,000
March 3, 1881	20,000	July 13, 1892	70,000
August 2, 1882	20,000		
July 5, 1884	10,000	Total	225,000

OPERATIONS TO JUNE 30, 1893.

Work was begun under the original approved project in 1878 and continued during the low-water season of each year until 1883. During this period the average annual appropriation was $24,000. With this amount much snagging was done and works of contraction were built at eight of the most troublesome bars, viz, the Cut-off, Haines Island, Hobbs Island, and Yellow Jacket, between Selma and the mouth, and Gardners Island, Hadnot, Cox, and Three Chutes bars in the upper portion, between Selma and Montgomery. From 1884 to 1891 the average annual appropriations were $9,375, which amount was only sufficient to continue snagging operations and to remove the annual accumulation of similar obstructions, brought into the river by freshets, and the fallen timber due to the caving and washing of the banks. Consequently no new works of contraction were built, and those previously constructed deteriorated more or less from want of funds to keep them in repair. Much useful work was accomplished, however, by the snag boat, and, as many of the shoals were caused by the accumulation of sand and gravel about sunken logs and snags, a number of these shoals were permanently improved by the removal of the logs and snags without resorting to works of contraction.

Before the improvement was begun in 1878, the river was so obstructed by logs, snags, fallen trees, and overhanging timber on the banks and by bars and shoals, on many of which the low-water depth was only 2.5 to 3.5 feet, that navigation was both difficult and dangerous. During the low-water season boats could only run during the daytime: long detentions were frequent at the shoals and bars in the river below Selma, and traffic between Selma and Montgomery was completely stopped.

At the close of 1891 the channel throughout the entire length of the river was practically free from obstructions and the banks from dangerous overhanging timber. The depth on the shoals and bars below Selma was nowhere less than 3.5 feet at low water, and boats made regular and uninterrupted trips throughout the year. Traffic was suspended between Montgomery and Selma when the river was at extreme low water, because the depth on Three Chutes Shoals, 2½ miles below Montgomery, was only 2½ feet at that stage of the river.

In accordance with recommendation contained in the report of examinations and partial surveys, printed in the Annual Report of the Chief of Engineers for 1876, p. 497, and 1891, p. 1761, the present plan of improvement was adopted, which provides for obtaining a low-water channel 6 feet in depth and 300 feet in width from Wetumpka to the mouth of this river, at an estimated cost of $386,251, exclusive of maintenance and snagging operations, which is estimated at $10,000 per year.

CONDITION OF IMPROVEMENT JUNE 30, 1893.

As the steam snag boat *Wm. J. Twining* was the only boat belonging to the Alabama River when the appropriation of $70,000 made by act approved July 13, 1892, became available, a large proportion of that amount had to be expended in procuring a suitable plant for continuing the improvement under the new project. Meanwhile a temporary plant, consisting of the steamer *Coosada* and two barges belonging to the Coosa River, the log boat belonging to the Cahaba River, which had been fitted out as a pile-driver and turned over to this improvement, and one purchased barge, having been provided, work was begun July 17, 1892, at Three Chutes Shoals. Snagging was carried on until September, 1892. Two stone barges, two quarter boats, and one brush barge having been purchased and a working party formed, works of contraction were begun October 2, 1892, at Silver Creek Shoals, 210 miles south of Montgomery, and carried on until December 9, 1892, when all operations were suspended on account of high water.

During the working season of 1892 works of contraction were partially constructed at the following-named bars and shoals: Three Chutes Shoals, Hadnot Bar, Manack Island, between Montgomery and Selma, and Silver Creek Shoals in the lower river. At the close of the working season, December, 1892, the depth of water had been increased over the bars at the several places as follows: Over the upper bar at Three Chutes, from 3 to 5.5 feet; at Hadnot, from 3.5 to 5.5 feet; at Manack Island, from 3 feet to 4.5 feet, giving a minimum depth of 4 feet between Montgomery and Selma, a distance of 81 miles, except on the lower bar at Three Chutes, where it was only 30 inches at extreme low water. At Silver Creek Shoals the depth was increased from 3 to 5 feet. The river throughout its entire length had been freed from snags, logs, and overhanging timber dangerous to navigation.

During the spring of 1893, the steamer *Coosada* was thoroughly overhauled, remodeled, and completely fitted out for use on this improvement; two stone barges, one pile-driver, and two small barges for carrying piles were purchased. These, with the barges and quarter boats purchased during the previous fall, furnished an efficient plant for two working parties. Each plant consisted of one steam towboat, one pile-driver, one quarter boat, one barge for carrying piles, one brush barge, and two stone barges. The *Twining* began snagging operations at the mouth of the river, June 14, 1893, and by June 30 had worked over its entire length, a distance of 311½ miles. All snags and logs visible in the channel and such overhanging timber as was dangerous were removed.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer C. B. Percy, who has been in local charge of the work, reports as follows:

The balance available for this improvement on July 1, 1893, being $30,629.29, snagging was begun on that portion of the Coosa River between Wetumpka and its junction with the Tallapoosa, a length of 10 miles. All obstructions were removed by July 3, 1893. Continuous work of this nature was then suspended on the entire improvement, and during the remainder of the working season of 1893 such logs, snags, and overhanging trees as were reported were removed. The amount of work done and the cost thereof is given in the tabulated statement attached.

The entire plant resumed operations July 6, 1893, on works of contraction in the river as follows:

WORK DONE BY PARTY NO. 1.

1. Three Chutes Shoals, 2½ miles below Montgomery.—Dam No. 1, at the upper end of the island, was completed by extending the island end 12 feet and raising the dam throughout its entire length to a uniform height of 4 feet above low water. Its total length is 535 feet.

Dam No. 2, located on the shoal below the island, was begun during the fall of 1892 and was built to the low-water level for a length of 1,050 feet. During 1893 this portion was raised to a height of 4 feet above low water and the dam was extended 557 feet farther, but the lower 150 feet of this extension was brought up only to the low-water level. While the dam was being raised and extended, bars were continually forming just beyond its end. To counteract this trouble and to carry the drifting sand and gravel at once to deep water a short spur dam, 122 feet in length, was built 340 feet below the end of Dam No. 2.

2. *Cox Bar, 11 miles below Montgomery.*—Some years ago an effort was made to increase the depth in this chute by making a dam of small willow stakes, driven close by hand and filled in with sand and gravel. This was soon destroyed and no material benefit was obtained. During September, 1893, another dam was built, as shown by the accompanying map. The length of the dam is as follows: Piling, 270 feet; bar protection, 153 feet, and a shore riprap, 30 feet, making a total length of 453 feet.

3. *Hadnot Bar, 13 miles below Montgomery.*—Was improved some years ago, but the work being done in a manner similar to that at Cox Bar, has been destroyed. The present work was begun in 1892 and completed during October, 1893, by raising 125 feet of its length to a 4-foot height, extending the bar protection 53 feet, and reenforcing the shore protection, making a total length of dam 594 feet. For method of construction see accompanying map.

4. *Manack Island Shoals, 19 miles below Montgomery.*—The dam across the smaller chute, at one time the main channel of the river, begun in 1891, was finished during August, 1893. Its height throughout its length was raised to 4 feet above low water. The island end was lengthened by 129 feet. Its total length is now 384 feet.

5. *Tyus Bar, 45 miles below Montgomery.*—The river is increased here from the normal width of 450 to 715 feet. A flat bar, exposed only at low water, divides it into two chutes, the navigable channel shifting from one to the other. A dam was constructed at the head of the north chute, as shown in the accompanying map, to confine the water in one permanent channel. The dam is 599 feet in length, made up of 44 feet of shore protection, 285 feet of pile dam, and a bar protection 270 feet long.

Funds available for this improvement being very nearly exhausted, work was suspended, the party discharged, and the plant laid up December 10, 1893, at Manack Island to await further appropriations.

WORK DONE BY PARTY NO. 2.

Silver Creek Shoals, 210 miles below Montgomery.—The improvement of these shoals, begun in the fall of 1892, was resumed July 17, 1893, and completed December 18, 1893. Dam No. 1, located at the upper end of the island and closing the north chute, was extended down the island 255 feet, and was raised to 4 feet above low water throughout its entire length of 1,050 feet. Dam No. 2, which is a longitudinal training dam, located on the shoal below the island, was extended 225 feet and raised to 3 feet above low water throughout its entire length of 952 feet. Dam No. 1 was built as shown in accompanying map; dam No. 2 was constructed according to the general plan adopted for this river.

Shackleford Bar, 236 miles below Montgomery.—The width of the river is increased here from the normal, 650 feet, to 1,000 feet, and a bar, which is exposed only at low water, divides it into two shifting channels. To confine the water in one channel a transverse dam, constructed according to the general plan, was begun and completed during October, 1893. This dam includes a shore protection 160 feet long, 259 feet of piling, and an extension on the bar of 150 feet, making its total length 569 feet, all of which is 3 feet above low water.

Carter Shoals, 243 miles below Montgomery.—The width between the banks at these shoals is increased from the normal, 700 feet, to 1,010 feet. A shoal lying in the middle of the river has a shallow chute on each side. The channel shifts from one to the other; its depth at low tide and low stage of the river is 3.5 feet. To confine the water in the west channel a longitudinal dam was located, running diagonally out from the east bank. The work of driving piles was begun November 17, 1893, and of making and sinking the mattresses on December 5, 1893. The upper portion of the dam, as far as the angle, had been built up to the level of low water and the piling extended 385 feet down the river by December 16, 1893, when operations were suspended.

Aberdeen Bar, 265 miles below Montgomery, and 38 miles above the mouth.—A longitudinal dam, 1,320 feet in length, with its top 4 feet above low water, and built as shown in accompanying map, was begun August 22, 1893, and completed October 17, 1893.

Work of party No. 2 was suspended December 16, 1893, and the plant started for Manack Island in tow of the steamer *W. J. Twining*. The tow arrived at that point December 23, 1893, and after removing some logs with the *Twining* from the river at Turnipseed Bar Chute, and a slip-in from Hadnot and from Cox Bar Chute, on December 25, 1893, the entire plant was laid up and all work suspended December 26 to await further appropriations.

The material employed in the construction of the improvements was obtained as follows: Rock was quarried from the bluffs and brush cut from the banks by hired labor; 3 cents per ton was paid for quarry privileges. Piles were purchased from planters along the river.

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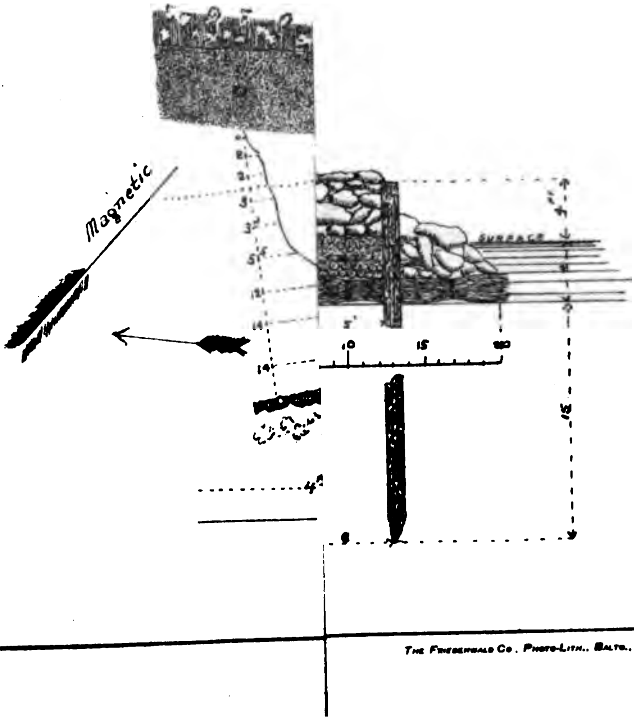
Capt. Ph



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The work of both parties was practically uninterrupted during the season, except by the difficulty of getting rock and by the long, tedious tow.

Improvements.	Distance below Montgomery, Ala.	Rock deposited.	Sacks of gravel deposited.	Brush and cane deposited.	Brush and cane woven into mattresses.	Average length, 25 feet; average diameter, 13 inches; average depth, 16 feet.	Stakes driven.	Poles wattled.	Mattresses laid in dam.
Three Chutes Shoals:	*Miles.*	*Tons.*	*No.*	*Cords.*	*Cords.*	*No.*	*No.*	*No.*	*Lin. ft.*
Dam No. 1	2.50	177.8							
Dam No. 2	3	1,517.4	15	69	376	95			600
Dam No. 3	3.25	219.3			60	24		55	75
Cox Bar	11	554.3				108			423
Hadnot Bar	13	145.5	140	3	35	57			
Manack Island	19	173.8					62		
Tyus Bar	45	832.4	1,210	66	326	98		34	584
Haines Island	204					24			
Silver Creek Shoals:									
Dam No. 1	210	365	325						
Dam No. 2	211	1,406			62	45		450	174
Shackleford Bar	236	1,669			181	52			570
Carter Shoals	243	540			74	110	50		580
Aberdeen Bar	265	3,337			322	260			1,320
Total		10,937.5	1,690	138	1,544	765	112	539	4,326

Improvements.	Mattress laid in shore protection.	Shore protection built.	Shore protection extended.	Bar protection built.	Bar protection extended.	Bar protection raised 2.5 feet.	Dam built.	Dam partially built.	Dam raised 2.5 feet.
Three Chutes Shoals:	*Sq. yds.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*	*Lin. ft.*
Dam No. 1					12	112			
Dam No. 2							317	150	1,050
Dam No. 3	102	47					75		
Cox Bar	100	30		153			270		
Hadnot Bar	167		37		53	130			374
Manack Island					30	99			240
Tyus Bar	98	44		270			285		
Haines Island									
Silver Creek Shoals:									
Dam No. 1					323	112			318
Dam No. 2							225		685
Shackleford Bar	284	160		150			259		
Carter Shoals	110	100						750	
Aberdeen Bar	82	26					1,294		
Total	943	407	37	573	418	453	2,727	900	3,039

Statement of work done with amounts available July 1, 1892, and appropriated July 13, 1892.

Classification of work.	Fiscal year.		Total.
	1892–'93.	1893–'94.	
WORKS OF CONTRACTION.			
Rock—			
Quarried, not delivered ....tons..	....	305	305
Quarried, delivered ....do....	....	9, 108	9, 108
Picked up along banks ....do....	....	1, 829	1, 829
Deposited in dams ....do....	4, 378	10, 937	15, 315
Earth stripped from rock ledges..........cubic yards..	319	4, 687	5, 006
Boxes and sacks of gravel deposited in dams..........number..	4, 046	1, 690	5, 736
Brush and cane—			
Cut and delivered ....cords..	1, 575	1, 682	3, 257
Woven into mattress ....do....	644	1, 544	2, 188
Deposited in dams..........do....	931	138	1, 069
Mattress laid—			
In dams..........linear feet..	2, 061	4, 326	6, 387
In shore protection..........square yards..	442	943	1, 385
Piles driven in dams..........number..	801	765	1, 566
Stakes driven in dams..........do....	240	112	352
Poles wattled ....do....	738	539	1, 277
Old dam—			
Rebuilt ....linear feet..	75	....	75
Lowered 1 foot..........do....	200	....	200
Torn out ....do....	....	80	80
Dams—			
Commenced and completed ....do....	....	2, 727	2, 727
Completed (partially built in 1892)..........do....	....	3, 039	3, 039
Partially completed ....do....	....	900	900
Shore protection commenced and completed..........square yards..	442	943	1, 385
Bar protection—			
Commenced and completed ....linear feet..	285	573	858
Extended ....do....	....	418	418
Completed (partially built in 1892) ....do....	....	453	453
SNAGGING OPERATIONS.			
Overhanging trees—			
Removed..........number..	1, 954	584	2, 538
Trimmed..........do....	191	8	199
Bushes cut (estimated)..........do....		1, 050	1, 050
Logs on bank cut up..........do....	133	121	254
Stumps on bank cut level..........do....	65	1	66
Logs, snags, and stumps removed from channel..........do....	758	117	875
MISCELLANEOUS WORK.			
Rock bowlders—			
Removed from landings..........cubic yards..	195	....	195
Removed from river..........do....	35	....	35
Bars deepened 1 foot by raking ....linear feet..	1, 675	....	1, 675
Surveys made and maps drawn..........number..	....	8	8

Statement showing length of dams as constructed.

Location of dams.	Partly built during fiscal year 1892–'93.			As completed during fiscal year 1893–'94.			Total length.
	Shore.	River.	Bar.	Shore.	River.	Bar.	
Three Chutes Shoals:							
Dam No. 1..........	39	372	112	39	372	124	535
Dam No. 2	90	1, 050	....	90	1, 367	....	1, 457
Dam No. 3	....	....	....	47	75	....	123
Cox Bar..........	....	....	....	30	270	153	453
Hadnot Bar	37	374	130	37	374	183	594
Manack Island	15	240	99	15	240	129	384
Tyus Bar..........	....	....	....	44	285	270	599
Silver Creek Shoals:							
Dam No. 1..........	112	318	396	112	318	720	1, 150
Dam No. 2..........	42	685	....	42	910	....	952
Shackleford Bar..........	....	....	....	160	259	150	569
Carter Shoals..........	....	....	....	100	....	....	100
Aberdeen Bar..........	....	....	....	26	1, 294	....	1, 320
Total..........	335	3, 039	737	742	5, 764	1, 729	8, 235

Statement showing length of dams as constructed—Continued.

	Uncompleted.	Total length.
Three Chutes Shoals: Dam No. 2	150	150
Carter Shoals	750	750
Total	900	900

Statement of expenditures during the fiscal years of 1892-'93 and 1893-'94.

Expenditures.	Fiscal years.		Total.
	1892-'93.	1893-'94.	
WORKS OF CONTRACTION.			
Labor and engineering and superintendence	$8, 854. 27	$15, 793. 26	
Materials	1, 244. 93	1, 199. 93	
Ammunition	110. 20	307. 55	
Subsistence supplies	3, 418. 88	3, 881. 24	
Engine supplies and fuel	1, 508. 37	1, 871. 73	
Total	15, 136. 65	23, 053. 71	$38, 190. 36
SNAGGING OPERATIONS.			
Labor and engineering and superintendence	2, 037. 46	506. 00	
Subsistence supplies	406. 14	118. 84	
Engine supplies and fuel	283. 13	115. 05	
Total	2, 726. 73	739. 89	3, 336. 62
MISCELLANEOUS.			
Preservation and repairs	1, 406. 86	2, 290. 57	
Expenses Montgomery office	654. 81	1, 159. 80	
Traveling expenses and transportation of funds, etc	162. 90	120. 61	
General repairs to plant	1, 354. 67	157. 04	
Sundry purchases	42. 60	65. 79	
Total	3, 621. 84	3, 793. 81	7, 415. 65
COST OF PLANT.			
stone barges 70 by 20 by 3 feet			2, 300. 00
2 stone barges 70 by 20 by 4 feet			2, 470. 00
2 pile barges 45 by 15 by 3 feet			1, 150. 00
1 brush barge 80 by 25 by 4 feet (second hand)			488. 01
1 brush barge 75 by 25 by 3 feet			998. 92
2 quarter boats 60 by 20 by 2 feet 2 inches			2, 594. 42
Pile-driver No. 2, 64 by 19 feet by 3 feet 9 inches			3, 591. 93
Hoisting engine and pile-driver frame with hammer for pile-driver No. 1			599. 00
Repairs to steamer *Coosada*			8, 544. 00
Outfit for entire plant			2, 209. 24
Total			24, 945. 52
Grand total			73, 918. 15

CONDITION OF IMPROVEMENT JUNE 30, 1894.

The improvement obtained at each of the bars where work has been done is shown in the following table:

Place.	Distance from Montgomery.	Present depth.	Increase of depth during year.
	Miles.	*Feet.*	*Feet.*
Three Chutes	2. 5	5	1. 75
Cox Bar	11	4. 5	1. 5
Hadnot Bar	13	5	2
Manack Island	19	5. 5	2. 7
Tyus Bar	45	5. 5	2
Silver Creek Shoals	210	5. 5	2. 5
Shackleford Bar	236	5	1. 5
Carter Shoals*	243		
Aberdeen Bar	265	7	3. 5

* Results are not given at Carter Shoals because the work is not finished.

The minimum low-water depth in the Alabama River between Mon gomery and the mouth, at the close of the fiscal year ending June 3 1894, was 4 feet, except at the head of Lower Gause Bar, 4 miles bel Montgomery, where it is about 3.5 feet. The channel throughout th entire length of the river was practically free from snags and logs, an the banks of overhanging trees dangerous to navigation. An efficie and well-equipped plant, amply sufficient for two working parties, i now on hand.

The plant is in good condition, with the exception of the stern-whe snag boat *Wm. J. Twining* and the brush barge, which was purchas at secondhand. The *Twining* will require to be docked; the hull w have to be thoroughly overhauled and repaired. This steamer was la docked in July, 1887. The brush barge will also have to be dock some bottom plank replaced, gunwales and deck repaired, and botto and deck recalked.

RECOMMENDATIONS AND ESTIMATES.

It is very desirable, in the interest of economy, that sufficiently larg appropriations should be made in order fully to utilize the plant, an by the employment of a large working force, to complete the improv ment as rapidly as practicable.

It is estimated that $200,000 can be profitably expended during th fiscal year ending June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$38,741.
June 30, 1894, amount received, refund, etc	149.
	38,891.
June 30, 1894, amount expended during fiscal year	34,798.
July 1, 1894, balance unexpended	4,092.
July 1, 1894, outstanding liabilities	856.
July 1, 1894, balance available	3,236.
Amount (estimated) required for completion of existing project, excluding cost of annual maintenance and snagging, $10,000 per year	336,251.
Amount that can be profitably expended in fiscal year ending June 30, 1896	200,000.
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following statement of the business done by the steamboats named bel during the fiscal year ending June 30, 1894, has been compiled from statements f nished by Capt. John Quill, of the steamer *Nettie Quill;* by Capt. W. H. Eanes, the steamer *Carrier;* by Capt. Owen Finnegan, of the steamer *Alto*, and by Capt. H. Moore, of the People's Line of Steamers, whose steamboats run between Mo and Montgomery, stopping at all intermediate landings; and by R. Barry, of steamboat *Minnie Lee,* a trading boat plying between Mobile and landings on the lower Alabama River:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Feet.*			
Nettie Quill	226.93	28	6.6	34	Mobile and Montgomery	4,117
Carrier	140.88	24	5.6	19		1,615
Alto	363.16	30	7	28		2,800
Tinsie Moore	198.29	24	5.6	50		6,033
Minnie Lee	98	22	5.6	16	Mobile and Harris Landing.	....
Barge Tide	320.01	12	2.6	....	Mobile and Bells Landing.	....

Freight carried.

Articles.	Quantity.	Tons.
Cotton .... bales..	46,774	11,694
Cotton seed .... sacks..	86,362	4,545
Fertilizers .... do...	78,509	5,608
Hides and skins .... packages..	529	132
Live stock .... head..	699	295
Lumber .... feet..	104,677	254
Staves .... pieces..	105,603	1,225
Provisions .... packages..	145,352	12,646
Grain .... sacks..	123,187	9,476
Miscellaneous freight .... packages..	75,639	9,455
Total	....	55,330

In addition to the commerce carried on by the above boats, the rafting business on the river is very large. Great quantities of sawed and hewed timber and logs are rafted annually, but available records of this business are not kept.

P 9.

IMPROVEMENT OF COOSA RIVER, GEORGIA AND ALABAMA.

PLAN OF IMPROVEMENT.

Beginning at Mobile, Ala., the Mobile River, 44 miles long, the Alabama River, 312 miles long, the Coosa River, 315 miles long, the Oostenaula River, 60 miles long, the Coosawattee, navigable for 45 miles, form, in fact, one great river, which rises in northwestern Georgia and flows through the mineral fields of north Alabama, the agricultural belt of midddle Alabama, and the timber region of south Alabama.

The Oostenaula and Coosawattee rivers above Rome, Ga., are navigable for light-draft boats during nine months of the year for a distance of 105 miles. Below Rome the Coosa is navigable during the entire year a distance of 188 miles to Lock No. 4, 3 miles above the Georgia Pacific Railroad bridge. Between Lock No. 4 and Wetumpka, a distance of 116 miles, the navigation of the Coosa is obstructed by a series of rocky reefs and shoals, separated by stretches of good navigable water, varying in length from one-half to 8 miles. The total fall in the low-water surface of this section of the river is 323 feet. The low-water discharge at Wetumpka is 5,800 cubic feet, the same as that reported for the Mississippi River at St. Paul. Below Wetumpka the

Coosa, Alabama, and Mobile rivers afford good navigation during the entire year to tide water at Mobile Bay.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of the various examinations and surveys, which are printed in the Annual Reports of the Chief of Engineers for 1871, 1872, 1875, 1878, 1881, and 1890.

The project provides for the removal of the lesser rock shoals and sand and gravel bars by excavation and by works of contraction, and for the construction of locks and dams to overcome the more serious obstructions.

By the various acts making appropriations the river has been divided into two sections, and separate appropriations have been made for each section.

The upper section, between Rome and the East Tennessee, Virginia and Georgia Railroad bridge, a distance of 236 miles, eight locks, with their accessory dams, will be required. Of these, three have been completed, and the fourth is now under construction. The work is carried on downstream in order that the completion of each lock and dam may immediately open an additional section of the river to the steamboats now running on the upper river.

In the lower section, between Wetumpka and the East Tennessee, Virginia and Georgia Railroad bridge, a distance of 68 miles, twenty-three locks, with their accessory dams, will be required. The first appropriation for this section of the river was made by the act of September 19, 1890, which required that the work should be commenced at Wetumpka.

1. BETWEEN ROME, GA., AND THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

APPROPRIATIONS.

August 14, 1876	$30,000	August 5, 1886	$45,000
June 18, 1878	75,000	August 11, 1888	60,000
March 3, 1879	45,000	September 19, 1890	150,000
June 14, 1880	75,000	July 13, 1892	130,000
March 5, 1881	60,000		
August 2, 1882	83,700	Total	803,700
July 5, 1884	50,000		

OPERATIONS TO JUNE 30, 1893.

Between 1876 and 1881 the principal obstructions in the channel between Rome, Ga., and Greensport, Ala., had been removed, and a number of bars and rocky reefs improved by regulation works and excavation in the rock. Steamboats then made regular trips between Rome and Gadsden, and occasional trips to Greensport, Ala.

Below Greensport, at distances respectively of 0.68, 3.86, and 5.24 miles, three masonry locks, each 40 feet wide by 210 feet between miter sills, with their accessory dams, had been completed and opened to navigation. During the year 1892 Dam No. 4, about 3 miles above Riverside, Ala., on the Georgia Pacific Railroad, had been nearly completed, and, with the work at Lonnergan Reef, made navigation practicable on a moderate rise in the river as far as the dam.

At Lock No. 4, 25.89 miles below Greensport, the cofferdam had been completed and efforts made to stop the leaks which had developed in the bottom of the lock pit; nearly all the stone for the lock walls was cut except the coping; the main dam across the river was completed; the levee and abutments, except laying the coping, and the shore protection below it were finished.

In the section between Locks Nos. 3 and 4, a distance of 21 miles, a low-water channel of 3 feet had been secured at three of the reefs immediately below Lock No. 3, the most serious of which is Lonnergan. Between Lonnergan Reefs and Box Shoals, some work had been done at six of the smaller reefs. At Box Shoals, the most serious obstruction in this section, a low-water channel of 2 feet depth and 50 feet width had been obtained.

WORK DONE DURING PAST FISCAL YEAR.

Mr. D. M. Andrews, assistant engineer, in local charge of the improvement of this section of the river, submits the following report:

All work was done by hired labor. It was confined to Lock No. 4, and channel work between Locks Nos. 3 and 4.

The work at Lock No. 4 is divided thus: (*a*) Cofferdam and stock-ramming. (*b*) Quarrying and cutting stone for masonry of the lock walls. (*c*) Repairs to the main dam across the river. (*d*) Laying abutment coping and shore protection. (*e*) Preparing foundation and laying lock masonry. (*f*) Building dry dock for repairing steamer and barges.

(*a*) Authority was granted, June 21, 1893, to move the lock downstream 113 feet in order to avoid the leakage from the upper pool which had developed after the construction of the dam across the river. In order to accomplish this, it became necessary to build a bulkhead across the upper end of the cofferdam. The details of the cost of this bulkhead and stock-ramming the cofferdam are as follows:

Cofferdam:	
Crib work	$956.50
Clay filling	352.89
Stock-ramming	111.62
Engineering and superintendence	219.20
	1,640.21

The rock of the foundation of this lock is a Devonian limestone, which has been partly replaced by silica, the latter retaining all the bad features of the limestone formation with the additional disadvantage of being badly disintegrated. The reefs or layers are generally separated by clay seams of varying thickness, the whole being little better than a mass of bowlders for resisting the passage of water.

In the effort to control the leaks developed in the foundation as the excavation progressed, small areas were inclosed by interior cofferdams, and the attempt made to pump them out, but at the time of the suspension of the work in November last, little headway had been made toward preparing the wall foundations.

(*b*) As previously stated, nearly all the stone had been cut at the end of the last fiscal year except the wall coping. Since then a small quantity has been quarried and cut; the coping, however, still remains to be cut. The following table gives in detail the cost of such work as was done:

Quarrying and cutting stone.

Class of stone.	Quantity.	Cost per unit.	Amount.
	Cubic yds.		
Quarry-face ashlar	1.30	$11.27	$14.65
Pointed face ashlar	10.94	12.26	134.12
Special ashlar	5.55	13.72	76.15
Miter-sill ashlar	36.58	13.15	481.03
Checks (ladder and bulkhead)	4.18	17.42	72.82
Coping:			
Hollow quoins	6.61	29.05	192.02
Main wall	11.80	22.31	263.25
Abutment	1.02	13.79	14.07
Miter sill	17.27	25.40	438.66
Material			28.00
Holiday (July 4, 1893)			81.73
Quarrying (labor and material)	534	1.70+	912.28
Engineering and superintendence			418.85
Total			3,127.63

(*c*) During the high water of 1892 and 1893 the timber crest of the main dam was lifted in places and the steps sustained slight injuries. The cost of repairs was as follows:

Labor and material	$1,939.80
Engineering and superintendence	300.67
Total	2,240.47

(*d*) Some of the shore protection below the abutment, which had been carried away by the high water, was replaced by a slope of heavier stone. The following table gives the total cost of the abutment complete:

Masonry-abutment Lock No. 4.

Class of work.	Quantity.	Cost per unit.	Amount.
Excavation for foundation, including pumping ......cubic yards..	3,219	$1.85	$5,963.20
Pile foundation ......linear feet..	4,860	.14	680.40
Concrete ......cubic yards..	310	2.94	911.40
Sheathing face ......feet, B. M..	9,000	20.43	183.87
Clay filling ......cubic yards..	2,496	.23¾	592.80
Masonry backing ......do....	644.79	7.90	5,096.74
Masonry ashlar ......do....	351	18.80	6,598.80
Masonry coping ......do....	21.62	24.45	528.61
Shore protection below dry rubble masonry ......do....	710.49	3.82+	2,716.37
Engineering and superintendence			100.72
Total			23,372.91

(*e*) A small part of the upper end of the river wall has been laid at a cost as follows:

Construction of Lock No. 4.

Class of work.	Quantity.	Cost per unit.	Amount.
Labor, laying, and shaping backing		$2.59½	$925.21
Material		2.04	727.46
Derricks and filling back wall	356.6	.31	110.55
Pumping		1.25	4,468.46
Excavating for foundation		.63	3,546.88
Stopping leaks			888.09
Engineering and superintendence			1,650.32
Total			$12,316.97

(*f*) A dry dock for repairing the boats belonging to the improvement has been constructed on the canal between Locks Nos. 2 and 3. This was accomplished by dredging out an area of the proper dimensions to accommodate the largest boat at a cost of $585.22.

CHANNEL WORK.

Box Shoals.—The channel here has been deepened by blasting and dredging at a cost as follows:

Labor and material	$1,658.40
Engineering and superintendence	260.70
	1,919.10

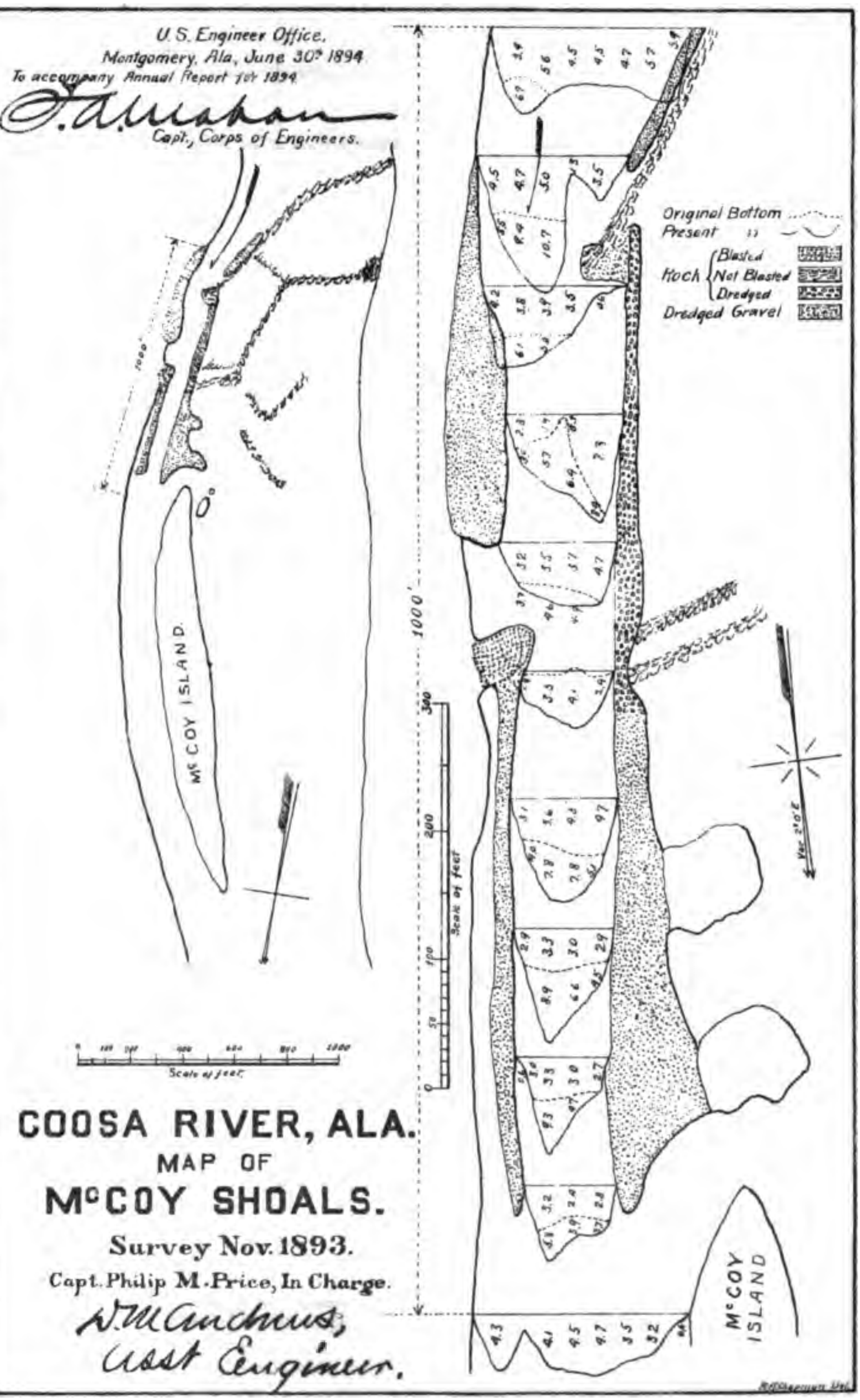
McCoy Island.—The work consisted of blasting and dredging a channel through the gravel and rock and the construction of training dams. A map is submitted showing the location and condition of the channel at the end of the fiscal year. The following table gives the cost in detail:

Class of work.	Quantity.	Cost per unit.	Amount.
Building training dams			$109.92
Rock blasting ......cubic yards..	850	$1.14¼	971.60
Dredging rock ......do....	850	.44¼	376.27
Dredging gravel ......do....	4,789	.19¼	923.38
Engineering and superintendence			305.19
Total			2,686.36

Of this amount $405.72 was expended during the fiscal year ending June 30, 1893.

U. S. Engineer Office,
Montgomery, Ala., June 30th 1894.
To accompany Annual Report for 1894.

F. A. Mahan
Capt., Corps of Engineers.



COOSA RIVER, ALA.

MAP OF

McCOY SHOALS.

Survey Nov. 1893.

Capt. Philip M. Price, In Charge.

W. M. Andrews,
Asst Engineer.

Woods Reef.—A channel has been dredged through the gravel bar at this point at a cost as follows:

Labor and material	2,240 cubic yards, at 6¼ cents	$138.06
Engineering and superintendence	2,240 cubic yards, at 1 cent	22.40
		160.46

At the following reefs no quantities are given, because the work had not progressed far enough for these to be obtained. The cost of the work at each, including engineering and superintendence, however, is given as follows:

Alligator Reefs, channel blasted and partly dredged	$3,291.70
Hunnicutt Reefs, channel blasted	787.30
Fomby Reefs, channel blasted	700.47
Williams Reefs, channel blasted	144.28

The following is a statement of the expenditures for the fiscal year ending June 30, 1894:

Channel work between Locks Nos. 3 and 4	$8,028.71
Cofferdam Lock No. 4	1,421.01
Quarrying and cutting stone	2,708.78
Construction of Lock No. 4	10,666.65
Other work of preparation for masonry of Lock No. 4	1,599.95
Repairs to Dam No. 4	1,939.80
Maintenance and operating towboat	2,942.01
Laying coping and shore protection, west abutment	656.23
Repairs to buildings	249.04
Expenses Montgomery office	915.00
Addition to plant and material on hand	1,660.77
Repairs to barges	81.13
Engineering and superintendence	5,866.20
Traveling expenses and transportation of funds	252.61
Recording gauge at Lock No. 5	60.00
Building dry dock	585.22
Total	39,634.11

CONDITION OF IMPROVEMENT JUNE 30, 1894.

Lock No. 4.—The abutment of the dam has been completed; nearly all the stone for the masonry cut; the foundation for the lock wall partly excavated, and some of the wall masonry laid.

Channel work.—The narrow channel at Box Shoals has been deepened; the channel at McCoy Island and Woods Reefs has been opened to navigation; the channel at Alligator Reef has been blasted and partly dredged. At Williams, Hunnicutt, and Fomby reefs the blasting has been finished, but no dredging has been done.

RECOMMENDATIONS AND ESTIMATES.

My predecessor, Capt. Philip M. Price, Corps of Engineers, makes the following remark in his report for the year ending June 30, 1893, and I agree fully with what he says:

> A work of this magnitude can be carried on much more economically and completed at a much less ultimate cost with large appropriations, which will enable the work to proceed without interruption and with efficient plant and a large working force.

The first appropriation was made for the Coosa River eighteen years ago. Since then three locks and dams have been finished and one has been started above the East Tennessee, Virginia and Georgia Railroad bridge and one has been begun below this bridge. Judging by present appearances, from the meager appropriations made for this river it will be four years before these two incomplete works will be finished. In other words, twenty-two years will have been required to build five

locks and dams. At this rate it will be one hundred and eighteen years before the locks and dams of the Coosa River will be finished. It must be borne in mind that the finished locks are small as compared with those yet unfinished and yet to be built. Allowing for this difference in size, the time required to finish this improvement at the present rate of progress can be put safely at somewhere between one hundred and twenty-five and one hundred and fifty years.

Only $3,888.91 is now on hand, and no work can be done until a new appropriation is had.

It is important that water transportation to the coast for its coal and for its iron ores should be given to the section affected by this improvement. For this purpose $600,000 can be profitably expended in the fiscal year ending June 30, 1896.

Money statement.

July 1, 1893, balance unexpended	$50, 292. 56
June 30, 1894, amount expended during fiscal year	46, 403. 65
July 1, 1894, balance unexpended	3, 888. 91
July 1, 1894, outstanding liabilities	1, 700. 28
July 1, 1894, balance available	2, 188. 63
Amount (estimated) required for completion of existing project	960, 133. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	600, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The following statistics reported by the White Star Line Steamboat Company, and the Lathrop-Hatten Lumber Company are submitted. It has not been practicable to obtain a report of the lumber rafted by other lumber firms or by private individuals:

Stern-wheel steamboats.	Registered tonnage.	Draft of water.		Passengers carried.	Round trips made and between what places.
		Light.	Loaded.		
		Inches.	*Inches.*		
Clifford B. Seay	115. 80	19	52	1, 680	33: Rome, Ga., and Gadsden, Ala.
Resaca				1, 760	Greensport, locks Nos. 1, 2, and 3, Alabama.

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	19, 000	4, 600
Cotton seed	sacks	24, 000	1, 100
Fertilizers	do	21, 000	2, 100
Hides and skins	packages	100	5
Live stock	head	75	30
Lumber	feet	11, 000, 000	33, 000
Staves	pieces	2, 000, 000	1, 700
Provisions	packages	26, 500	1, 600
Grain	sacks	65, 000	3, 400
Miscellaneous freight	packages	60, 000	7, 600
Total			55, 135
Estimated value of above freight in round numbers			$1, 350, 000

The president of the Lathrop-Hatten Lumber Company makes the following statement with his report:

"The dam at Lock No. 4, with the lock uncompleted, proves a great hindrance to the moving of our stock and material which has to be transferred over the dam, causing us a loss of $2,000 to $2,500 per year. This loss would be avoided were the lock in operation, and would enable us to double our present volume of business.

* * * * * * * *

"The river, if open to Mobile, would give us the benefit of a grand waterway for our coal, iron, and lumber to the seaboard."

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2. BETWEEN WETUMPKA, ALA., AND THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

APPROPRIATIONS.

September 19, 1890	$150,000
July 13, 1892	100,000

OPERATIONS TO JUNE 30, 1893.

In October, 1890, a party was organized and stationed at Wetumpka, Ala., to make the detailed surveys necessary for the precise location of locks Nos. 31, 30, and 29, and to make a series of velocity and discharge measurements at all stages of the river from low to high water. The party was engaged in this work during the remainder of the fiscal year.

CONDITION OF IMPROVEMENT JUNE 30, 1893.

Actual work on the improvement of this portion of the river was commenced September 7, 1891. By June 30, 1893, the land on the bank of the river, abreast of the site of the lock, had been acquired by condemnation proceedings after considerable delay. Much the greater part of the ground was occupied by a deep ravine or gully lying parallel with the river. A lock yard was made by depositing in this gully about 6,000 cubic yards of earth and rock, removed in connection with the channel work in the river; most of the necessary workshops, sheds, etc., were erected. The lock-keeper's house, which is in use temporarily as office and quarters, was built. The cofferdam was partially constructed, 380 linear feet out of a total of 845 feet having been completed. A contract had been made for the supply and delivery of about 900 cubic yards of cut stone for facing the walls of the lock above low-water level, but, owing to the failure of the contractor to carry out his agreement, the contract was annulled. It was decided then to abandon the cut stone facing and to use concrete throughout, except in the case of hollow quoins and other special stone. About 205 cubic yards of stone, which had been delivered under the contract and which will be used in this and the succeeding locks wherever it may be deemed advantageous to do so, was subsequently purchased at a reduced rate.

In order to obtain sand for the concrete, a dredge boat was built on the works and a sand-pumping outfit was erected thereon; two barges for carrying the sand were built and an inclined railway, with a large sand bin at the head of it, was laid from low-water line to the top of the bank.

Materials were purchased for the construction of a large building, to be roofed and covered with corrugated iron, and its erection was begun. This building will contain the storage of cement supply and the necessary machinery for mixing the concrete, etc.

Proposals for the construction of a concrete mixing and distributing plant had been called for, but the contracts had not been finally awarded.

Proposals for the supply and delivery of about 110 cubic yards of hollow quoins and other special stones had also been called for.

Rock excavation in the channel above the lock was completed in October, 1891, and 9,052 cubic yards had been removed up to the end of the fiscal year ending June 30, 1893. A No. 3 Gates rock crusher had been erected on the river bank opposite the channel, and 561 cubic yards of hard trap bowlders had been crushed and stored at the same point for use in the concrete.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer Charles Firth, in local charge of the work on this section of the river, reports as follows:

Operations during the year have been confined to the site of Lock No. 31, to the channel work at the head of the rapids above the lock, and to the construction of a 3-foot gauge railroad connecting these two points with each other and with the Louisville and Nashville station yard in Wetumpka.

The condition of the river throughout the year has been, on the whole, very favorable to the successful prosecution of the work, only thirty days having been lost by high water outside of the regular winter flood. This flood, though unusually low, was sufficiently extended to prevent all work in the river from December 29, 1893, to April 30, 1894.

The most important work in progress at the beginning of the fiscal year was the construction of the cofferdam, of which 380 running feet, out of a total of 845 feet, had been completed during the previous year. The sinking of the cribs progress very rapidly and satisfactorily, but by the middle of July much deeper water was suddenly reached, and the rock bottom was found overlaid with an accumulation of sand mixed with leaves, twigs, and snags to a depth of from 10 to 15 feet. The sand pump was put to work on this mixture, but it was found to be almost useless, as the débris choked the suction pipe. An attempt was then made to pull the material out of the way with an improvised rake, worked by a capstan on the dredger, but this only took off the larger pieces of wood which might be lying loose on or near the surface. The smaller sticks passed between the teeth of the rake, and for want of sufficient power half-buried snags held it fast altogether. Inquiries were next made as to the feasibility of hiring a steam dipper dredge, but none was available. As a last resource, therefore, it was decided to work continuously, night and day, with divers and the sand pump. Three gangs of men were organized, with two divers to each gang; the divers collected the sticks, etc., by hand, and deposited them in a large wood and iron cage or basket, lowered down to them by a derrick, and at the same time they moved the suction pipe of the pump among the pockets of sand, which kept accumulating; they also kept the suction end of the pipe as clear of débris as possible. This method, though somewhat slow and tedious, was successful. As soon as a sufficient space had been laid bare to the rock on the line of the cofferdam, the cribs were sunk from time to time and the superstructure was built up from the water level to the finished level of the dam. The sheathing was carried forward, the outer cribs were filled with broken stone at once, and the inner cribs were well weighted down until they and the core between the lines of cribs could be filled with clay. The greatest depth of water at the site of the dam was 28 feet at low water.

The timber work of the cofferdam was completed by October 5, and by November 14 the filling was finished. In order to economize time the lower wall and about 100 feet of the outer wall of the cofferdam were filled by washing the clay from near the clay pit into the dam by means of an inclined trough supplied with water by the sand pump. This method proved to be cheaper than the long haul by train all around the dam would have been, and it also permitted the use of the track for other purposes.

On pumping the water out of the lock pit leaks occurred several times at different places. These were found to exist where the cofferdam had been built across the overhanging rocks. Dependence had therefore to be placed solely upon the clay filling for the exclusion of the water. Each leak carried into the lock pit a very large quantity of the clay filling, which had to be replaced. These leaks were stopped by ramming a mixture of cement and clay in the proportion of 1 to 2 down a 4-inch pipe to the seat of the trouble. The mixture was allowed to harden for a few days before pumping was resumed. The cofferdam is now absolutely water-tight. The estimated cost of the whole work, as per drawing, dated July 9, 1892, was $27,162.90. The actual cost has been as follows:

Detailed cost of cofferdam.

Class of work.	Quantities.	Cost per unit.	Amount.
Cribwork and sheathing............feet, B. M..	961, 150	$19. 55	$18, 790. 48
Clay filling............cubic yards..	11, 096	. 35	3, 883. 60
Stone filling............do....	4, 022	. 56	2, 252. 32
Sluice pipe and valve............	....	....	265. 75
Preparing foundation............	....	....	1, 621. 22
Stopping leaks............	....	....	782. 15
Railroad from clay pit to cofferdam............	....	....	1, 770. 08
Engineering, superintendence, etc............	....	....	2, 289. 30
Total............	....	....	31, 654. 90

On closing the cofferdam the sand dredger was left inside, where she pumped a considerable proportion of the sand and mud over the top of the dam before the high-water season, during which she was floated out.

It was thought advisable to purchase a duplicate pumping outfit for the lock pit in order to prevent delay in case of a breakdown or of necessary repairs, and also to get rid of the water quickly after the cofferdam had been submerged by floods. This last accident has occurred sufficiently often in some years to fill the lock pit almost every month.

Accordingly two 10-inch vertical centrifugal pumps, two 11 by 15 inch horizontal engines, and two 50-horse power boilers, with the necessary fittings, were purchased from the Morris Machine Works, of Baldwinsville, N. Y. The engines were erected on a crib built on the cofferdam, about 8 feet higher than the top of the latter, so that time would be gained in which to remove them after the water had flooded the lock pit. The boilers were erected on the river bank out of reach of any flood likely to take place. Notwithstanding the distance between the boilers and engines (about 400 feet), the pump can be operated with 60 pounds of steam at the boiler, by the use of a 4-inch steam pipe, asbestus covered and boxed in.

Work in the lock pit commenced on May 22, 1894. About 4,000 cubic yards of sand and loose material have been removed, and about 1,000 cubic yards of solid rock excavated and piled behind the line of the land wall of the lock.

The next work of importance in progress at the close of the previous fiscal year was the erection of a cement house, and of a concrete mixing and distributing plant. A drawing accompanies this report, which shows the general arrangement of this plant. The building is put together so as to be taken to pieces readily after the work at Lock No. 31 is completed, in order to be reerected at Lock No. 30. It could be used, probably, at Lock No. 29 after doing its work at No. 30.

Detailed drawings of the concrete mixers and concrete dump cars, and of a cement-testing machine, designed and constructed for this work, are submitted with this report.

The cars used in handling the sand and broken stone are of the side-dump pattern, and are brought into the charging room on either side of the hoppers. The cement is drawn from the cement room overhead, in proper quantities, through vertical chutes arranged somewhat on the principle of the old-fashioned powderflask.

The water is added to the materials as they enter the mixers and the quantity, which will probably be variable with the temperature, is controlled by valves on the mixing floor, the operator being governed by indicators, which show the quantity used.

The mixers are cubical boxes 4 feet on each side, inside measurement, made of steel plate five-sixteenths of an inch thick, with 2½ by ½ inch angle irons. Each mixer is provided with a door in one corner, 22 inches square, fastened with a tempered spring steel catch, and held open when required with a hinged screw bolt, not shown on the drawing. The shaft which revolves the mixers is 3 inches square. It is securely fastened to them by trunnion castings at diagonally opposite corners. The whole is driven by a 10 by 16 inch horizontal engine, and thrown in and out of gear by ordinary friction gearing with friction and brake levers. Steam is supplied by the boiler operating the sand incline.

After a sufficient number of revolutions in the mixers, the concrete is dumped into the concrete cars below, which are of the center-dump pattern, and so designed as to dump on the release of a catch and to recover their upright position when empty. The loaded cars are run out to either elevator from either mixer and are lowered to the level of the track over the lock wall. Each loaded car going down brings an empty one up. The elevator cages are suspended from a drum overhead, which is controlled by a friction brake and lever.

The capacity of the cement floor is 1,000 barrels. The cement is brought in on cars, from which it is lifted to the floor level by means of small hand derricks without winches. The capacity of the sand bin is 3,000 cubic yards. The sand is pumped from the river bed into barges, from which it is hauled up the bank in cars which dump directly into the bin. The broken stone bin has a capacity of 1,250 cubic yards. It is filled from the train which brings the stone from the crusher stationed at the site of the channel work, about a half mile above the lock.

At one end of the cement house is the cement testing room, where every consignment of cement is tested for weight, fineness, checking, time of setting, and tensile strength. The briquettes are made of neat cement and also of 1 part of cement to 3 parts of sand. They are of 1 square inch area at the smallest section and are broken in a specially designed machine, in which the weight is applied by water supplied at the rate of 400 pounds per minute. The water is drawn from a tank with a constant head. The advantages claimed for the machine are simplicity, absolute regularity in applying the strain, and total absence of jar or shaking.

All of the machinery and cars were purchased by contract. Their erection and that of the building, etc., were done by hired labor.

The total cost of the whole plant, including everything but the boilers supplying the steam, was as follows:

DETAILED COST OF CONCRETE PLANT.

Machinery, cars, etc	$3,225.60
Lumber, corrugated iron, rails, etc	1,382.31
Labor erecting house, trestling, machinery, etc	2,561.04
Engineering, superintendence, etc	783.00
Total	7,951.95

Rock excavation in the channel at the head of Wetumpka Rapids has progressed very favorably throughout the year, the total suspension for the winter extending from January 10 to May 20. About 14,505 cubic yards of solid rock has been removed in all. It was either crushed, deposited along the bank for bank protection, or used up in the cofferdam and in various ways in and around the lock site.

Up to the suspension for the winter, about 550 cubic yards of the hard trap bowlder stone had been crushed and stored for concrete. No decision had been reached when work ceased as to whether the softer rock found might be used in the concrete. It has been found on further examination that this softer rock is of sufficiently good quality for use in the heart of the walls, the harder rock being reserved for the faces to a thickness of about 2 feet on each face. This will result in a very large saving in the total cost of the work. Since the recommencement of the channel work, 2,135 cubic yards of the softer stone has been crushed and stored, making a total of 2,685 cubic yards of both kinds crushed during the fiscal year. It is not expected, however, that sufficient hard rock will be obtained from the channel work, and the balance will therefore have to be brought in by rail from elsewhere. In order to facilitate handling this stone and also the larger quantity of cement which will be used in the work, it was thought to be economical, as all the rolling stock is already in hand, to build a light 3-foot-gauge railroad from the lock yard up to the Louisville and Nashville Railroad yard, and a branch of the same to the rock-crushing plant. Authority was therefore obtained from the Chief of Engineers and from the Wetumpka City Council to build the road. Work was commenced on it on April 10 and finished to the rock crusher by May 10; this portion was done first in order to remove as much as possible of the stone to the lock yard, as the storage ground at the crusher was becoming crowded. Owing to delays in receiving materials, the track to the railroad yard was not completed until June 30. This track will eventually be extended to the site of Lock No. 30 as soon as work is commenced at that point.

Detailed statement of cost of railroad to stone-crushing plant and Louisville and Nashville R. R. depot.

Rails, spikes, splices, etc	$1,316.87
Ties and lumber for trestle, culverts, and crossings	533.18
Grading and laying track	1,673.99
Superintendence, etc	443.67
Total	3,967.71

A large lumber shed was erected in the lock yard for heavy carpenter work and for storing dried lumber out of the weather. All of the lumber and ironwork for the concrete molds was purchased and made ready for use.

The following is a list of the minor works executed during the year: Two row boats built, water-closet and sewer for lock-keeper's house, shed built over main pump boilers, removable shed built over pumping engines, broken stone storage bin built in lock yard, 915 feet of railroad sidings laid in lock yard, all floating craft caulked and painted, old box sewer in yard raised and repaired, stone monuments cut and erected at corners of Government reservation.

Statement of cost of work during fiscal year ending June 30, 1894.

[Including outstanding liabilities of $4,850.31, and excluding liabilities of $5,053.70 of June 30, 1893, paid during the year.]

Completion of cofferdam, including stopping leaks	$12,952.54
Rock excavation in channel (14,505 cubic yards)	12,426.02
Plant and tools purchased	6,908.90
Cement house and concrete mixing and distributing plant	6,732.01
Granite dimension stone (hollow quoins), including advertising and inspection	5,769.24
Railroad to depot and to stone crusher	3,967.71
Pumping out and excavating 1,000 cubic yards of rock and 4,000 cubic yards of sand from lock pit	3,915.22
Cut stone purchased from Lithonia Granite Company, after failure of contractor (183.36 cubic yards)	2,614.97
Montgomery office expenses	2,149.09
Care of and repairs and alterations to plant and tools	2,115.28
Stone crushed (2,685 cubic yards, at 64.1 cents)	1,720.85
Concrete molds, materials, and labor	1,095.81
Subsistence, forage, and firewood	1,011.91
Workshops, sheds, etc	802.86
Engineering and superintendence not properly chargeable to any particular work	518.44
Care of property during high water	320.54
Railroad sidings in yard	303.74
Crushed-stone bin at lock yard	302.71
Additions and repairs to lock-keeper's house, including water-closet, sewer, and repairs to roof	213.08
Broken stone hauled to lock yard (1,250 cubic yards, at 17 cents)	210.43
Sand pumped and stored in bin (370 cubic yards, at 53.4 cents	197.87
Recording gauges	162.00
Rent of telephones	120.00
Blue printing and photographing materials	83.43
Two row boats	81.75
Traveling expenses not charged to any particular work	29.08
Bridge and ferry tolls	29.00
Cutting and setting stone monuments for boundary of Government reservation	27.50
Total	66,781.98

CONDITION OF IMPROVEMENT JUNE 30, 1894.

All the temporary work is complete; the entire outfit of plant required for the construction of this and succeeding locks is erected and in first-class working order; materials are on hand to begin concreting, which will be started as soon as the rock excavation in the lock pit shall be far enough advanced. The channel work at the head of the rapids above the lock is drawing near completion, but work will continue to be carried on there in order to supply broken stone for the concrete.

RECOMMENDATIONS AND ESTIMATES.

It is expected that the balance of the appropriation now available will be expended by August 31, 1894, and unless the river and harbor bill of this year becomes law and the amount therein recommended becomes available, the temporary work already done will deteriorate rapidly, and when work is resumed a large sum of money and considerable time will be required to restore them to their present condition.

Should the new appropriation be sufficient, Lock No. 31 will be completed and the construction of Locks Nos. 30 and 29 will be begun with it. Nearly all the plant bought for the construction of Lock No. 31 will be transferred successively to the locks above it, and the cost of building these locks will therefore be considerably less than that of Lock No. 31. It is therefore recommended that $600,000 be appropriated for the year ending June 30, 1895.

I desire to invite especial attention to the following paragraph in the last annual report of my predecessor, Capt. Philip M. Price, Corps of Engineers:

> An improvement of this magnitude can be carried on economically and completed within a reasonable time only by the appropriation of sufficiently large amounts to enable the work to proceed without interruption on account of lack of funds.

I am emphatically in accord with this remark. Every day on which work might be, but is not, done represents not merely the negative loss of no work done, but the positive loss of injury to unfinished work; a positive loss by deterioration of plant standing idle; a positive loss of time for watchmen to protect property; a positive loss of time of employés, many of them at high wages, who must be kept so as to be in readiness to carry on the work when funds are made available. Steady appropriations allow of keeping together working gangs of men skilled in particular classes of work; uncertain appropriations require these gangs to be broken up and new gangs to be formed by whom the skill of practice has to be acquired.

Money statement.

July 1, 1893, balance unexpended		$141, 798. 55
June 30, 1894, amount received, refund		7. 25
		141, 805. 80
June 30, 1894, amount expended during fiscal year		67, 043. 24
July 1, 1894, balance unexpended		74, 762. 56
July 1, 1894, outstanding liabilities	$4, 889. 82	
July 1, 1894, amount covered by uncompleted contracts	24, 300. 00	
		29, 189. 82
July 1, 1894, balance available		45, 572. 74
Amount (estimated) required for completion of existing project		4, 843, 074. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896		600, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of bids received by Capt. F. A. Mahan, Corps of Engineers, for furnishing 10,000 barrels, more or less, of Portland cement, delivered at Wetumpka, Ala. (improving Coosa River, Georgia and Alabama, between Wetumpka, Ala., and East Tennessee, Virginia and Georgia Railroad bridge), opened April 12, 1894.

No.	Name and address of bidder.	Brand.	Net weight of barrels.	Net weight of sacks.	Sacks made of—	Price per barrel.	Price per sack.
			Pounds.	*Pounds.*			*Cents.*
1	Atlas Cement Co., New York	Atlas	380	126	Burlap	*$2.43	74
2	Jos. T. Walker, Savannah, Ga.	Gibbs	375			2.73	
3	Fleming Cement and Brick Co., New York.	Black Cross	375			2.82	
4	E. Thiele, New York	Heyn Bros Dyckerhoff & Sons.	375 375			2.84 3.19	
5	M. M. Ruttenan, New York	Eagle	395			2.68	
6	A. C. Babson, New York	Alsen	376			2.62	
7	A. V. Clubbs, Pensacola, Fla.	...do	373			2.59	

* Recommended for acceptance.

COMMERCIAL STATISTICS.

On March 15, 1887, the Coosa River Improvement Convention, composed of representative citizens of Alabama and Georgia, and presided over by the governor of Alabama, assembled at Montgomery and prepared a memorial to Congress.

The memorial contains detailed statistics, and after describing the advantages to be derived from the improvement of the Coosa River, concludes with the following summary:

"The Coosa River presents the cheapest and most certain water route to the Gulf of Mexico of the coal, iron, cotton, and cereals of a vast extent of country.

"The removal of the obstructions which cut in half this river, now navigable for hundreds of miles below and above such obstructions, is a national duty, in view of the commerce it would pour into the Gulf of Mexico. The opening of the Coosa would enable the Government to move munitions of war from the interior to the seaboard safely and expeditiously.

' It would place the navigable waters of the Coosa so close to the navigable waters of the Tennessee that water communication between the two streams must certainly follow, and thus afford the Tennessee River and its vast tributaries an outlet to the gulf by way of the bay of Mobile."

P 10.

OPERATING AND CARE OF CANALS AND OTHER WORKS OF NAVIGATION ON COOSA RIVER, GEORGIA AND ALABAMA.

The expenses of operating and care of Locks Nos. 1, 2, and 3 and canal between Locks Nos. 2 and 3 during the past year have been paid in the manner indicated by section 4, act of July 5, 1884.

Mr. D. M. Andrews, who is in local charge of the work, reports as follows:

The locks have been in operation during the year with only one accident, caused by the breaking of the maneuvering ropes of the gates at Lock No. 3. These were repaired without interfering with navigation.

Repairs and improvements have been as follows:

Lock No. 1.—The gates have been repaired by the renewal of the parts exposed at low water. Some general repairs to the lock yard and lock-keeper's dwelling have been made.

Lock No. 2.—The maneuvering machinery of the upper gates has been replaced by gear of the spar and capstan type. The Government road from the reservation to the county road has been repaired. Some minor repairs to the lock yard and lock-keeper's dwelling have been made.

Lock No. 3.—The Government road from the reservation to the county road has been repaired; besides this and the renewals and repairs of the maneuvering ropes, some general repairs to the lock yard and lock-keeper's dwelling have been made.

As required by law, the following statement of expenses is submitted:

Statement of expenses incurred during the fiscal year ending June 30, 1894, in operating and keeping in repair Locks Nos. 1, 2, and 3 and the canal between Locks Nos. 2 and 3, Coosa River, Georgia and Alabama.

[Including outstanding liabilities June 30, 1894, and excluding the sum of $346.20, paid in settlement of outstanding liabilities of fiscal year ending June 30, 1893.]

Lock No. 1:			
Operating, lock-keeper's salary, 12 months, at $50		$600.00	
Repairs to gates—			
Labor	$726.67		
Material	166.39		
		893.06	
General repairs		25.81	
Lock No. 2:			$1,518.87
Operating, lock-keeper's salary, 12 months, at $50		600.00	
Repairs to right of way		50.94	
Repairs to gate machinery		26.60	
General repairs		7.00	
Lock No. 3:			684.54
Operating, lock-keeper's salary, 12 months, at $50		600.00	
Repairs to right of way		65.85	
General repairs		127.04	
Miscellaneous:			792.89
Transportation of funds		1.62	
Engineering and superintendence		500.00	
Expenses. Montgomery office		175.00	
			676.62
Total			3,672.92

Money statement.

July 1, 1893, balance unexpended	$1,802.73
Allotment	2,216.02
	4,018.75
June 30, 1894, amount expended during fiscal year	3,418.16
July 1, 1894, balance unexpended	600.59
July 1, 1894, outstanding liabilities	600.59

P II.

IMPROVEMENT OF CAHABA RIVER, ALABAMA.

PLAN OF IMPROVEMENT.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of surveys and examinations printed in the Annual Reports of the Chief of Engineers for 1875, p. 11, and for 1881, p. 1232.

The project contemplates obtaining a navigable channel from its mouth to the town of Centerville, a distance of 88 miles, by the removal of snags, logs, etc., from the channel, cutting overhanging trees from the banks, excavating the soft rock and gravel bars, and deepening sand bars by works of contraction and shore protection, the channel to be 3 feet deep at low water, 100 feet wide in open river, and 60 feet wide through the bars.

Above Centerville the river is a series of pools and rapids, having a fall of 109.2 feet in 21 miles. This portion of the river passes through the extensive Cahaba coal fields, but can only be made navigable by a system of locks and dams. Below Centerville the river is a series of pools and rapids, having a fall of 127.4 feet in 88 miles.

The act of August 5, 1886, appropriated $7,000 for continuing the improvement, but with the proviso that "no part of said sum shall be expended until the officer in charge shall have reported that the railroad and other bridges crossing said river have been provided with good and suitable draw openings." No changes had, in the meantime, been made in the bridges, but the act of September 19, 1890, provided that "the existing provision restricting the expenditure of the balance available for the improvement of said river is hereby repealed, and the said balance shall be expended in continuing the improvement thereof."

APPROPRIATIONS.

August 2, 1882	$20,000
July 5, 1884	10,000
August 5, 1886	7,500
July 13, 1892	7,500
Total	45,000

OPERATIONS TO JUNE 30, 1893.

Operations were commenced July 8, 1892, at the junction of the Cahaba and Alabama rivers (20 miles below Selma on the latter), under the act approved July 13, 1892, appropriating $7,500 for continuing this improvement, and were continued until December 8, when work was suspended on account of high water, and as the high water season continued late in the spring of 1893, no further work was done during that fiscal year. A distance of 21¾ miles was partially cleared of overhanging trees on the banks, snags and logs were removed from the channel, and the river rendered navigable on a rise of 2 feet above low water for light-draft steamers, but the bridge of the Birmingham, Selma & New Orleans Railway, which crosses the river about 9 miles above the mouth, being without a draw-span, no attempt was made to utilize its improved condition. The plant employed was the one originally belonging to the Tallapoosa River which was substituted, by the authority of the Chief of Engineers, for the snag boat built for the Cahaba River, the latter having been fitted out as a pile-driver for use on the Alabama River.

WORK DONE DURING PAST FISCAL YEAR.

Assistant Engineer C. B. Percy, in local charge of the improvement, reports as follows:

> An available balance of $3,826.18 remained on July 1, 1893, for continuing the improvement. The snag boat, having been overhauled and refitted, was towed by the U. S. S. *W. J. Twining* to the mouth of the Cahaba River, the crew organized, and work resumed July 10. As a part of the work of the previous year had been done during rises of the river, and the accumulation of snags and logs due to the winter and spring freshets was considerable, operations were commenced at the mouth, and the 21¾ miles previously worked over was thoroughly cleared of all such obstructions by September 1; the work was continued up the river to a point 38 miles above the mouth and about 3½ miles below Fikes Ferry, which point was reached November 17.
>
> The funds available for this improvement being practically exhausted, work was suspended, the crew discharged, and the boat left in charge of the suboverseer to await a rise sufficient to bring it back to the village of Cahaba at the mouth. The boat reached this point December 1, and was towed by the steamer *Nettie Quill* up the Alabama River to Manack Island, 19 miles below Montgomery, where it was laid up with the Alabama River plant to await further appropriations.
>
> The work performed during the fiscal year ending June 30, 1894, comprised the

removal of snags from the river, and logs, stumps, and overhanging timber from the banks, dangerous to navigation, as follows:

Overhanging trees felled, cut up, or pulled back	4,417
Overhanging trees trimmed	175
Logs on bank cut up	314
Stumps on bank cut level with ground	1,132
Large trees, snags, and logs removed from the channel	1,477
Total	7,515

The total amount of work accomplished with the appropriation of $7,500, made in act approved July 13, 1892, is as follows:

Overhanging trees felled, cut up, or pulled back	9,516
Overhanging trees trimmed	785
Logs on bank cut up	848
Stumps on bank cut level with ground	1,476
Trees, snags, and logs removed from channel	2,575
Total	15,200
Cubic yards of rock removed	23
Old railroad bridge truss removed	1
Old flatboat wreck removed	1

* * * * * * *

From the point where the work was suspended (21½ miles from the mouth of the river), and for a distance of 49 miles to Centerville, the head of navigation, no work on the channel has been done except for a short distance in 1891. This portion of the river is completely obstructed with trees, snags, and accumulations of large drift, which, together with the overhanging timber on the banks, arching the river in many places, render navigation at any stage impossible.

RECOMMENDATIONS AND ESTIMATES.

Navigation on this river is now completely blocked by the bridge of the Birmingham, Selma and New Orleans Railroad, about 10 miles above the mouth of the river, and by the bridge of the Alabama Central Division of the East Tennessee, Virginia and Georgia Railroad, 22 miles above the mouth.

As no commercial benefit can be derived from continuing the improvement of the river while the bridges obstruct steamboat navigation, and as there is no apparent desire on the part of those interested to compel the placing of draws in the bridges, I do not consider that this river is worthy of any further attempt at improvement. I therefore recommend that the improvement be discontinued.

Money statement.

July 1, 1893, balance unexpended	$3,969.46
June 30, 1894, amount expended during fiscal year	3,914.85
July 1, 1894, balance unexpended	54.61
July 1, 1894, outstanding libilities	19.61
July 1, 1894, balance available	35.00

COMMERCIAL STATISTICS.

No steamboats have navigated this river for many years past, and no effort to do so will probably be made until the bridges of the railroads crossing it have been provided with suitable draw spans. Before the construction of the two railroad bridges across the river the entire cotton crop of the Cahaba Valley was carried on flatboats to the Alabama River, but since then, owing to the obstructing bridges and the bad condition of the river, navigation by craft of any kind has been practically abandoned.

A large amount of sawn and hewn timber and of saw logs of cypress, oak, and pine is annually rafted out of the river to Mobile, Ala., via the Alabama River, but no record of this business is kept and its amount can not be estimated.

APPENDIX Q.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI, AND OF BOGUE CHITTO, LOUISIANA.

REPORT OF MAJ. A. N. DAMRELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1894, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mobile Harbor, Alabama.
2. Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek.
3. Warrior and Tombigbee rivers, Alabama and Mississippi.
4. Noxubee River, Mississippi.
5. Pascagoula River, Mississippi.
6. Chickasahay River, Mississippi.
7. Leaf River, Mississippi.
8. Harbor at Biloxi, Miss.
9. Pearl River, below Jackson, Miss.
10. Pearl River, between Carthage and Jackson, Miss.
11. Pearl River, between Edinburg and Carthage, Miss.
12. Bogue Chitto, Louisiana.
13. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., July 14, 1894.

GENERAL: I have the honor to forward herewith annual reports * * * for the fiscal year ending June 30, 1894, for the following works under my charge.

* * * * * * *

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

Q 1.

IMPROVEMENT OF HARBOR AT MOBILE, ALABAMA.

The improvement of the channel of the harbor at Mobile, Ala., was begun by the General Government in 1827, the depth of water then being 5½ feet through Choctaw Pass and 8 feet on Dog River Bar.

The following appropriations were made by act of Congress:

May 20, 1826	$10,000.00
March 2, 1829	20,000.00
June 24, 1834	10,000.00
March 3, 1835	17,997.60
March 3, 1837	50,000.00
July 7, 1838	50,000.00
August 3, 1852	50,000.00
	207,997.60
By act of Congress, March 3, 1857 (relief claim)	20,833.08
Total	228,830.68

The result obtained was a channel 10 feet deep and 200 feet wide through the pass and the same depth with an unknown width over the bar. In 1860 the channel through the pass was found to have shoaled to 7½ feet, the depth of water on the bar remaining the same.

No further improvement was attempted until 1870.

From 1870 to 1875 the following amounts were appropriated for the purpose of obtaining a depth of 13 feet:

By act of Congress—	
July 11, 1870	$50,000
March 3, 1871	50,000
June 10, 1872	75,000
March 3, 1873	100,000
June 23, 1874	100,000
March 3, 1875	26,000
Total	401,000

Statement of work done under the above appropriations.

Date of act.	Name of contractor.	Contract price, measured in— Cut.	Contract price, measured in— Scow.	Cubic yards removed.	Commenced.	Completed.
		Cents.	*Cents.*			
July 11, 1870	John Grant	50.0		76,784	Sept. 15, 1870	Apr., 1872
Mar. 3, 1871	S. N. Kimball & Co	39.5		104,879	Jan. 2, 1872	Aug., 1872
June 10, 1872	John Grant	30.0		135,691	Dec., 1872	July 3, 1873
Do	J. E. Slaughter	45.0		61,084	Jan., 1874	July, 1874
Mar. 3, 1873	John Grant		23.00	371,220	Aug., 1873	Aug., 1874
June 23, 1874	J. P. Stewart		18.75	424,238	Oct., 1874	Feb., 1876
June 3, 1875	S. N. Kimball		17.00	132,015	Dec., 1875	Sept., 1876
	Total			1,305,911		

This amount was expended in dredging a channel 13 feet deep and 300 feet wide from the mouth of the Mobile River through Choctaw Pass, and 13 feet deep and 200 feet wide through Dog River Bar to the 13-foot curve in the bay. The work was completed in 1876, and the channel remained practically as it was dredged until operations were commenced under the new project to obtain a depth of 17 feet.

Act of June 18, 1878, appropriated the sum of $10,000 for a survey for a channel of 22 feet depth, and in March, 1880, it was decided to continue the former improvement by dredging to a depth of 17 feet, with a uniform width of 200 feet, from the 17-foot curve in Mobile River to the curve of the same depth in the lower bay, the estimated cost being $820,000.

From 1878 to June 30, 1887, the following amounts were appropriated:

By act of Congress—	
June 18, 1878 (survey)	$10,000
March 3, 1879	100,000
June 14, 1880	125,000
March 3, 1881	100,000
August 2, 1882	125,000
July 5, 1884	200,000
August 6, 1886	90,000
Total	750,000

Statement of work done under the above appropriations.

Date of act.	Name of contractor.	Contract price, measured in scow.	Cubic yards removed.	Commenced.	Completed.
		Cents.			
Mar. 13, 1879 June 14, 1880	George C. Fobes & Co.	12.3	1,610,804	Feb. 19, 1881	Nov. 9, 1882
Mar. 3, 1881	G. L. Long	11.7	724,730	Mar. 21, 1882	Jan. 21, 1884
Aug. 2, 1882	R. Moore	12.3	888,093	Jan. 24, 1883	Feb. 9, 1884
July 5, 1884	Tobias Burke	9.0	1,920,438	Sept. 19, 1884	June 15, 1886
Aug. 6, 1886	R. Moore	9.5	829,854	Oct. 2, 1886	Apr. 25, 1887
	Total		5,973,919		

The channel of 17 feet depth was practically completed in 1889, and a vessel passed through drawing 18 feet.

February 6, 1885, a project was submitted for the improvement of Mobile River and Harbor with a view of securing 23 feet depth of water, by dredging the channel, which since 1870 had been deepened in that manner, first from 9 to 13 feet and then from 13 to 17. The estimated cost of the 23-foot project, with extension made by act of September 19, 1890, is $2,043,800, made up as follows:

Completion of 17-foot channel (including removal of material filled in cut upon which estimate for 23-foot cut was based)	$282,000
Dredging channel 280 feet wide on top of cut and central depth of 23 feet	1,500,000
Removing material that will fill in during progress of work on 23-foot channel (during three years)	198,000
Dredging channel in Mobile River up to Chickasabogue, 280 feet wide and 23 feet deep	63,800
Total	2,043,800

To which must be added $60,000 per year after June 30, 1891, for removing material that will fill in during the progress of the work.

From August 11, 1888, to end of this fiscal year the following appropriations have been made:

By act of Congress—	
August 11, 1888	$250,000
September 19, 1890	350,000
July 13, 1892	212,500
Sundry civil act March 3, 1893	500,000
Total	1,300,500

Statement of work done under the above appropriations.

Date of act.	Name of contractor.	Contract price, measured — In cut.	Contract price, measured — In scow.	Cubic yards removed.	Character of material.	Commenced.	Completed.
		Cents.	*Cents.*				
Aug. 11, 1888	Alabama Dredging and Jetty Company.	......	9.0	2,312,293	6 per cent sand, 5 per cent shell.	Oct. 15, 1888	Feb. 17, 1890
Sept. 19, 1890	National Dredging Company.	......	8⅜	3,060,619	89 per cent soft clay, 5 per cent sand, 5 per cent shell.	Jan. 1, 1891	May 2, 1892
Do.......	Alabama Dredging and Jetty Company.	......	15.0	422,691	90 per cent soft clay, 60 per cent sand, 2 per cent per. ox.	July 1, 1891	Aug. 12, 1892
July 13, 1892	National Dredging Company.	......	7.7	7,711,835	38 per cent clay, 90 per cent soft clay, 3 per cent shell, 7 per cent sand.	Nov. 7, 1892	
Do.......	Rittenhouse Moore Dredging Company.	16½	....	44,684	19 per cent clay; 81 per cent sand.	Mar. 6, 1894	

Character of plant used under the above appropriations.

Date of act.	Name of contractor.	Plant. — Apparatus.	Plant. — Capacity of bucket.	Plant. — Capacity of scows.
Aug. 11, 1888.	Alabama Dredging and Jetty Co.	2 clam-shell dredges and 2 tugs.	4 cubic yards each.	274, 441, 489, and 495 cubic yards.
Sept. 19, 1890.	National Dredging Co.	3 clam-shell dredges, 3 scows, and 3 tugs.	3½, 4, and 4½ cubic yards each.	265, 296, 313, 319, 323, 495, 537, and 539 cubic yards.
Do.......	Alabama Dredging and Jetty Co.	1 clam-shell dredge, 2 scows, and 1 tug.	4 cubic yards.....	318 and 489 cubic yards.
July 13, 1892.	National Dredging Co.	5 clam-shell dredges, 19 scows, and 8 tugs.	2¾, 4, 4½, 6½, and 7⅞ cubic yards.	230, 260, 286 296, 308, 313, 318, 319 323, 489, 495, 526, 535, 537, 598, 616, 677, 745, and 747 cubic yards.
Do.......	Rittenhouse Moore Dredging Co.	1 clam-shell dredge, 1 pump dredge, 3 scows, and 2 tugs.	4 cubic yards; 12-inch suction.	230, 318, and 526 cubic yards.

Advertisements inviting proposals for dredging in Mobile River were published and opened July 11, 1893. Only one bid was received; the price, 22 cents, being considered too high, it was rejected. The work was readvertised and proposals opened September 28, 1893, and contract awarded to Rittenhouse Moore Dredging Company at 16½ cents per cubic yard.

Abstract of bids received and opened September 28, 1893, for dredging in Mobile River, Alabama.

No.	Name of bidder.	Price per cubic yard.	Time of commencement.	Time of completion.
		Cents.		
1	Geo. W. Catt, New York...........	17	In accordance with specifications.	In accordance with specifications.
2	Rittenhouse Moore Dredging Co., Mobile Ala.	16½	......do...............	Do.

MAXIMUM DAILY AND MONTHLY WORK DONE BY CONTRACTORS.

(*1*) *Alabama Dredging and Jetty Company.*—Maximum month's work, April, 1889, dredge *Thos. H. Herndon* excavated 149,508 cubic yards soft clay. Maximum day's work, December 31, 1888 (twenty-four hours), dredge *Thos. H. Herndon* excavated 6,916 cubic yards soft clay, with scow No. 1=441 cubic yards, and scow No. 3=489 cubic yards; lost time, four hours, twenty-five minutes—waiting for tug, oiling down, repairing dipper, scow door broken (1 well short); 1½ miles to dump. Tug *Mannie.*

(*2*) *National Dredging Company.*—Maximum month's work, February, 1892, dredge *Col. Craighill* excavated 133,246 cubic yards soft clay. Maximum day's work, July 1, 1891, dredge *Chas. Fobes* (fourteen hours, forty minutes) excavated 5,092 cubic yards soft clay; with scows A=319 cubic yards; C=308 cubic yards; E=266 cubic yards; lost time, two hours, thirty minutes—running anchor, repairing scow chain, passing steamer, hauling back to remove shoal, meals, and waiting for tug; 2 miles to dump. Tug *John Bacon.*

(*3*) *Alabama Dredging and Jetty Company.*—Maximum month's work, February, 1892, dredge *Gen'l Shelley* excavated 57,997 cubic yards sand and clay. Maximum day's work, dredge *Shelley* (twenty-four hours) excavated 4,228 cubic yards, February 19, 1892, sand and clay; with scows No. 2=318 cubic yards, and No. 4=286 cubic yards; lost time, six hours, five minutes—waiting on tug, hauling to next cut. Tug *Mannie*; distance to dump, 2 miles.

(*4*) *National Dredging Company.*—Maximum month's work, May, 1894, dredge *Chas. Fobes* excavated 249,856 cubic yards soft blue clay. Maximum day's work, dredge *Chas. Fobes* (twenty-four hours) excavated 12,410 cubic yards soft blue clay; with scows No. 1=634 cubic yards, and scow No. 2=677 cubic yards; lost time, two hours, fifteen minutes. Causes of delay, changing scows. Tug *Chief;* 2 miles to dumping ground.

(*5*) *Rittenhouse Moore Dredging Company.*—Maximum month's work, March, 1894, dredge *Thos. H. Herndon* excavated 28,864 cubic yards sand and little clay. Maximum day's work, dredge *Thos. H. Herndon* (twenty-four hours) excavated 2,850 cubic yards clay and sand; with scows M=490 cubic yards; D=323 cubic yards, and P=318 cubic yards (no lost time given); 5 miles to dumping ground. Tugs *Mannie* and *Lizzie Frank.*

Money statement.

July 1, 1893, balance unexpended		$552,302.07
June 30, 1894, amount expended during fiscal year		382,366.63
July 1, 1894, balance unexpended		169,935.44
July 1, 1894, outstanding liabilities	$104,153.89	
July 1, 1894, amount covered by uncompleted contracts	55,000.00	
		159,153.89
July 1, 1894, balance available		10,781.55
Amount (estimated) required for completion of existing project		681,300.00
Amount (estimated) required for preservation of improvement		240,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896		681,300.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Tabular statement showing the channel as dredged and its condition June 30, 1894.

Locality.	Dredged 1870-1894.		Examinations.			Maximum depth in cross section.		
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	June, 1891.	June, 1893.	June, 1894.
	Feet.	*Feet.*		*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
			Initial point at mouth of Chickasa bogue or Station 1	000	1,550	15.9	16.3	16.8
From Station 1 to 145 feet south of Station 4			0.25 mile south of initial point	From the initial point or Station 1 to Station 10, stations are 2,630 feet apart.	1,180	23.0	23	23.9
			0.79 mile south of initial point		970	21.3	23.6	23.5
			1.25 miles south of initial point		979	23	28	28+
			1.52 miles south of initial point		720	21.3	23.8	28+
From 145 feet south of Station 4 to 200 feet south of Station 5	80	23-24	1.61 miles south of initial point		810	19.7	24.2	23.7
	80	23-24	2.03 miles south of initial point		1,030	18.9	23.2	24.7
From 200 feet south of Station 5 to 1,925 feet south of Station 5	50	23-24	2.22 miles south of initial point		900	21.3	21.6	25.7
	50	23-24	2.36 miles south of initial point		880+	21.3	20.9	25.3
From 1,925 feet south of Station 5 to 100 feet south of Station 7	80	23-24	2.60 miles south of initial point		910	21.3	21.3	23.8
	80	23-24	2.82 miles south of initial point		960	17.6	21.1	24.1
	80	23-24	3.01 miles south of initial point		1,010	16.7	22.6	22
From 100 feet south of Station 7 to 1,210 feet south of Station 9	40	21.3-22.3	3.14 miles south of initial point		1,100	17.9	21.4	23.9
	40	21.3-22.3	3.39 miles south of initial point		1,310	16.5	19.7	19.6
	40	21.3-22.3	3.54 miles south of initial point		1,000+	17.1	21.8	22.3
	40	21.3-22.3	3.94 miles south of initial point		740	16.4	21.2	20.8
	40	21.3-22.3	4.21 miles south of initial point		660	19.7	22.4	21.8
	......	....	4.44 miles south of initial point		580	21.3	28+	24.7
	......	....	4.49 miles south of initial point		380	21.3	26.1	26.1
	......	....	4.54 miles south of initial point		660	21.3	26.9	28+
From 880 feet south of Station 10	240	23-24	4.66 miles south of initial point	2,070 feet to Station 11.*	700	18.9	23	23.8
	240	23-24	4.89 miles south of initial point		700	19.7	23.8	23.5
	240	23-24	5.04 miles south of initial point	820 feet to Station 12.	700	17.6	22.4	28+

*** Station 11 corresponds to the location of the chain cluster No. 1.**

The zero of the gauge is 13.51 feet below the horizontal top of the west abutment of the steps of the custom-house, Mobile, Ala.

Tabular statement showing the channel as dredged and its condition June 30, 1894—Continued.

Locality.	Dredged 1870–1894.		Examinations.					
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	Maximum depth in cross section.		
						June, 1891.	June, 1893.	June, 1894.
	Feet.	*Feet.*			*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station 13	240	23–24	5.35 miles south of initial point	1,650 feet to Station 13	700	19.6	22.8	24.1
Station 13 to 14	350	21.3–22.3	5.54 miles south of initial point	978 feet to Station 14	700	19.9	24.4	26+
Station 14 to 15	240	23–24	5.96 miles south of initial point	2,250 feet to Station 15	700	21.3	23.8	28+
Station 15 to 16	200	23–24	6.38 miles south of initial point	2,182 feet to Station 16	700	18.3	28+	26.9
Station 16 to 17	240	23–24	6.87 miles south of initial point	2,565 feet to Station 17	700	18.8	23.7	28+
Station 17 to 18	240	23–24	7.36 miles south of initial point	2,603 feet to Station 18	700	21.5	22.6	28+
Station 18 to 19	240	23–24	8.15 miles south of initial point	4,194 feet to Station 19	700+	26.3	22.9	28+
Station 19 to 20	240	23–24	8.41 miles south of initial point	1,338 feet to Station 20	700+	24.8	22.5	28+
Station 20 to 21	240	23–24	8.92 miles south of initial point	2,735 feet to Station 21	700+	21.8	20.3	28+
Station 22	240	23–24	9.50 miles south of initial point	2,998 feet to Station 22	700+	25	21.2	28+
Station 22 to 23	200	23–24	10.00 miles south of initial point	2,654 feet to Station 23	700+	26.3	21.7	25.5
Station 23 to 24	200	23–24	10.51 miles south of initial point	2,713 feet to Station 24	700+	16.9	21.5	25.4
Station 24 to 25	200	23–24	11.01 miles south of initial point	2,655 feet to Station 25	700+	16.7	21.5	23.4
Station 25 to 26	200	23–24	11.49 miles south of initial point	2,610 feet to Station 26	700+	16.1	21.6	25.5
Station 26 to 27	200	23–24	11.98 miles south of initial point	2,501 feet to Station 27	700+	16.5	20.2	24.1
Station 27 to 28	200	23–24	12.44 miles south of initial point	2,418 feet to Station 28	700+	16.4	20.6	28+
Station 28 to 29	200	23–24	12.93 miles south of initial point	2,625 feet to Station 29	700+	16.5	20.3	28+
Station 29 to 30	200	21–24	13.44 miles south of initial point	2,666 feet to Station 30	700+	16.2	19.7	25.2
Station 30 to 31	200	23–24	13.93 miles south of initial point	2,591 feet to Station 31	700+	15.9	28+	28
Station 31 to 32	200	23–24	14.40 miles south of initial point	2,582 feet to Station 32	700+	16.1	28+	24
Station 32 to 33	200	23–24	14.90 miles south of initial point	2,616 feet to Station 33	700+	16.2	26.5	28+
Station 33 to 34	200	23–24	15.42 miles south of initial point	2,659 feet to Station 34	700+	16.3	26	24
Station 35	200	23–24	15.91 miles south of initial point	2,580 feet to Station 35	700+	16.5	28+	24
Station 35 to 36	200	23–24	16.39 miles south of initial point	2,550 feet to Station 36	700+	16.1	24.3	28+
Station 36 to 37	200	23–24	16.90 miles south of initial point	2,590 feet to Station 37	700+	16.1	26.7	23.8
Station 37 to 38	200	23–24	17.36 miles south of initial point	2,502 feet to Station 38	700+	15.5	26.6	28+
Station 38 to 39	240	23–24	17.84 miles south of initial point	2,560 feet to Station 39	700+	15.7	26.4	28+
Station 39 to 40	240	23–24	18.32 miles south of initial point	2,535 feet to Station 40	700+	15.4	26.6	28+
Station 40 to 41	240	23–24	18.81 miles south of initial point	2,592 feet to Station 41	700+	15.5	28+	28+
Station 41 to 42	240	23–24	19.30 miles south of initial point	2,592 feet to Station 42	700+	15.3	28+	28+
Station 42 to 43	240	23–24	19.79 miles south of initial point	2,587 feet to Station 43	700+	15.4	28+	26.2
Station 43 to 44	200	23–24	20.29 miles south of initial point	2,620 feet to Station 44	700+	15	24.7	22.6
Station 44 to 45	200	23–24	20.47 miles south of initial point	940 feet to Station 45	700+	15	23.7	21.4
Station 45 to 46	200	23–24	20.62 miles south of initial point	840 feet to Station 46	700+	15	22	20.5

Tabular statement showing the channel as dredged and its condition June 30, 1894—Continued.

Locality.	Dredged channel.		Examinations.					
	Width.	Central depth.	Cross section at	Distance between stations.	Top width.	Maximum depth in cross section. June, 1891.	June, 1893.	June, 1894.
			Middle Bay Light.					
	Feet.	*Feet.*			*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station 46 to 47	[illegible]	23–24	20.8 miles south of initial point	918 feet to Station 47	700+	11.6	23.3	20.8
Station 47 to 48	[illegible]	23–24	21.1 miles south of initial point	1,655 feet to Station 48	700	11.6	22.6	21.7
Station 48 to 49	[illegible]	23–24	21.6 miles south of initial point	2,650 feet to Station 49	700	11.7	22.9	22.3
Station 49 to 50	[illegible]	23–24	22.1 miles south of initial point	2,750 feet to Station 50	700	11.3	21.3	20.8
Station 50 to 51	[illegible]	23–24	22.6 miles south of initial point	2,725 feet to Station 51	700	18.4	21.1	21.4
Station 51 to 52	200	23–24	23.17 miles south of initial point	2,750 feet to Station 52	700+	22	21	21.1
Station 52 to 53	[illegible]	23–24	23.67 miles south of initial point	2,615 feet to Station 53	700	22.8	21.7	22.4
Station 53 to 54	200	23–24	24.17 miles south of initial point	2,540 feet to Station 54	700	21.5	21.5	22.6
Station 54 to 55	200	23–24	24.66 miles south of initial point	2,695 feet to Station 55	700+	21.6	23	22.5
Station 55 to 56	240	23–24	25.17 miles south of initial point	2,705 feet to Station 56	700+	21.5	23	28+
Station 56 to 57	240	23–24	25.59 miles south of initial point	2,227 feet to Station 57	700+	19	24.2	28+
Station 57 to 58	240	23–24	26.19 miles south of initial point	3,160 feet to Station 58	700+	18	24.6	28+
Station 58 to 59	240	23–24	26.73 miles south of initial point	2,824 feet to Station 59	700+	13	20.1	28
To Station 60	240	23–24	27.23 miles south of initial point	2,660 feet to Station 60	700	13.2	19.6	22
Station 60 to 61	200	23–24	27.80 miles south of initial point	3,230 feet to Station 61	700	13.7	20	22.2
Station 61 to 62	200	23–24	28.25 miles south of initial point	2,146 feet to Station 62	700	13.7	20.8	24.7
Station 62 to 63	200	23–24	28.79 miles south of initial point	2,865 feet to Station 63	700	14.4	22.5	28+
Station 63 to 64	200	23–24	29.30 miles south of initial point	2,701 feet to Station 64	700	14.4	28+	28+
Station 64 to 65	200	23–24	29.84 miles south of initial point	2,833 feet to Station 65	700	15.3	28	26.3
Station 65 to 66	200	23–24	30.39 miles south of initial point	2,930 feet to Station 66	700	16	28	28+
Station 66 to 67	200	23–24	30.81 miles south of initial point	2,210 feet to Station 67	700+	16.1	28	28+
Station 67 to 68	120	23–24	31.04 miles south of initial point	1,200 feet to Station 68	700+	16.2	28+	28+
Station 68 to 69	120	23–24	31.49 miles south of initial point	2,400 feet to Station 69	700+	....	28+	28+
Station 69 to 70	120	23–24	31.95 miles south of initial point	2,400 feet to Station 70	700	....	28	28
Station 70 to 71	120	23–24	32.45 miles south of initial point	2,400 feet to Station 71	700	....	28	28
Station 71 to 72	80	23–24	32.86 miles south of initial point	2,400 feet to Station 72	700	....	26.5	26.9
Station 73	80	23–24	33.09 miles south of initial point Or lower 23 feet curve.	1,200 feet to Station 73	700	....	23.1	23.9

COMMERCIAL STATISTICS.

Description.	Entries.						Clearances.					
	1894.			1893.			1894.			1893.		
	No.	Tons.	Crews.	No.	Tons.	Crews.	No.	Tons.	Crews.	No.	Tons.	Crews.
Foreign	337	171,615	4,579	234	150,231	3,150	342	175,871	4,437	229	152,626	3,373
Coastwise	85	147,893	1,136	125	90,363	2,501	80	49,330	1,153	131	94,143	2,594
American	74	27,284	552	104	36,567	824	89	32,580	661	119	47,151	1,018
Total	496	346,792	6,267	463	277,161	6,475	511	257,781	6,251	479	293,920	6,985

Imports and exports.

Description.	1894.	1893.
Duties on imports	$10,257.13	$15,108.88
Tonnage dues	6,545.91	8,610.02
Hospital collections	....	....
Care and treatment of foreign sailors and overtime of officers	557.05	430.00
Official fees	2,491.33	2,052.53
Fines, penalties, and miscellaneous	.75	230.60
Miscellaneous	58.05	....
Total collections	19,990.22	26,432.03
Exports	2,823,037.00	3,319,381.10

Comparative statement of lumber, cotton, etc., shipped to foreign and coastwise ports.

Description.	1894.	1893.	1892.	1891.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Lumber	107,246	107,924	76,055	71,177
Timber	60,463	94,090	73,527	62,292
Cross-ties	10,076	8,876	4,451	....
Shingles	2,259	936	1,350	19
Cotton	9,835	....	....	....

Comparative statement of number and draft of vessels passing up and down the dredged channel during the fiscal year ending June 30, 1894.

Draft in feet.	Steamships.				Ships and barks.				Brigs.				Schooners.				Total.			
	Up.		Down.		Up.		Down.		Up.		Down.		Up.		Down.		Up.		Down.	
	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.	1894.	1893.
Under 13	174	103	115	19	81	102	1	1	16	18	....	5	190	187	85	104	451	410	201	129
13 to 14	8	10	13	6	21	20	6	5	....	....	7	2	....	3	27	28	29	33	53	41
14 to 15	2	2	12	57	18	5	9	4	....	....	....	7	....	....	37	27	20	7	58	95
15 to 16	1	2	33	20	5	4	14	9	....	1	5	....	8	3	25	14	14	10	77	43
16 to 17	1	1	6	2	1	....	13	16	....	1	3	....	1	....	22	5	3	2	44	23
17 to 18	....	....	5	2	1	....	12	40	....	....	....	....	....	1	3	2	1	1	20	41
18 to 19	....	....	....	5	1	....	16	27	....	....	....	....	....	....	....	1	1	....	16	33
19 to 20	....	....	1	....	....	....	12	22	....	....	....	....	....	....	....	....	....	....	13	22
20 and over	....	....	1	....	1	....	47	2	....	....	....	....	....	....	....	....	1	....	48	2
Total	186	118	186	111	129	131	130	126	16	20	15	14	199	194	199	181	520	463	530	432

On April 4, 1894, the bark *Asia* passed through the dredged channel of Mobile Bay, Alabama, without detention, drawing 22.7 feet.

Q 2.

IMPROVEMENT OF BLACK WARRIOR RIVER, ALABAMA, FROM TUSCALOOSA TO DANIELS CREEK.

Act of May 28, 1828, declared Black Warrior River, Alabama, free from all tolls except such as might be allowed by act of Congress (sec. 5244, Rev. Stat., ed. of 1878, p. 1015).

An examination and partial survey of the river from Locust Fork to Tuscaloosa, 47½ miles, was made in 1874.

A survey of the river from Tuscaloosa to forks of Sipsey and Mulberry, 92¼ miles, was made in the fall of 1879, as directed by act of Congress approved March 3, 1879.

The report thereon is contained in Report of Chief of Engineers, 1881, Part II, p. 1218.

Appropriations have been made as follows:

By act of—	
July 5, 1884	$50,000
August 5, 1886	56,250
August 11, 1888	100,000
September 19, 1890	150,000
July 13, 1892	200,000
Total	556,250

Detailed plans and estimates for a system of improvement by locks and movable dams were submitted December 19, 1885.

A Board of Engineers met in Tuscaloosa February 10, 1886, and recommended locks and fixed dams of increased lift.

Plans and estimates were again submitted August 13, 1886, and, with slight modifications, were recommended by the Board in their report of April 2, 1887. The project was approved May 19, 1887. The extent of the work is the construction of five locks and dams, with a total lift of 52 feet, between Tuscaloosa and Daniels Creek, 14¾ miles, and its purpose is to furnish slack-water navigation for barges of 6 feet draft.

The locks are to be 52 feet clear width, 322 feet long between hollow quoins, available length 285 feet, and to have a depth of 6½ feet on miter sills, and are to have iron gates. The dams are to be of rock-fill type. The estimated cost was $741,670, which was based on ten-hour days for labor. The estimated cost to complete the work is $307,000, which will bring the cost of the completed project up to $794,000, being about 8 per cent more than the original estimate.

Work was commenced in March, 1888, and has been carried on continuously since, with the exception of a suspension from September 1 to October 20, 1890, caused by exhaustion of funds.

Work done during the fiscal year ending June 30, 1894, was:

Masonry completely laid in Lock 3 and abutments 2 and 3.

Dam 3 commenced.

Needle dams put on each lock.

Two barges built, 18 by 58.

Gates for Lock 1 delivered, fitted up, and partly hung.

Channel below Lock 3 excavated.

The above work, itemized and analyzed, is shown below.

	Lock No. 1.	Lock No. 2.	Lock No. 3.	Total.	Remarks.
Engineering and office	$1,186.00	$353.59	$4,767.91	$6,307.50	8½ per cent.
Track and roads, maintenance and changes			292.83	292.83	
Cofferdams and pumping	485.10			485.10	Includes clearing out locks for hanging gates.
Rock excavation	214.18	38.93	3,724.12	3,977.23	4,181 cubic yards, 95 cents per cubic yard.
Handling and hauling stone	12.50	469.88	2,283.26	2,765.64	
Gates and valves	7,258.75	200.48	451.30	7,910.53	
Boats		69.06	1,158.89	1,227.95	Two barges built and one repaired.
Masonry		781.07	17,736.10	18,517.17	11,239 cubic yards, $1.65 per yard.
Tools and plant		13.75	4,817.40	4,831.15	
Stone cutting		41.00	8,650.00	8,691.00	1,374 cubic yards, $6.35 per yard.
Quarry			6,747.77	6,747.77	$1 28 per yard.
Earth excavation		362.40	744.13	1,106.53	4,409 cubic yards, 25 cents per yard.
Earth, back filling			1,859.26	1,859.26	5,546 cubic yards, 33½ cents per yard.
Paving	104.35	733.62	443.94	1,281.91	6,675 square yards, 19⅓ cents per square yard.
Dams	1,485.21	709.78	4,161.63	6,356.62	Mainly for material prepared.
Incidentals	115.75	292.08	1,169.73	1,577.56	
Guide cribs	404.80	354.20	809.64	1,568.64	One crib half done; timber for others delivered.

The present condition of the work is as follows:

Locks 1, 2, and 3 are completed, except gates and valves. These are now being put in Lock No. 1. The three dam abutments are also finished and the dams are in process of construction.

The gates and valves for Locks 2 and 3 will be prepared during the autumn and winter, and will be hung next summer, so that it is expected to have the three locks ready for navigation in the autumn of 1895.

Money statement.

July 1, 1893, balance unexpended	$151,815.11
June 30, 1894, amount expended during fiscal year	76,537.22
July 1, 1894, balance unexpended	75,277.89
July 1, 1894, outstanding liabilities	6,133.66
July 1, 1894, balance available	69,144.23
Amount (estimated) required for completion of existing project	238,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	238,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Q 3.

IMPROVEMENT OF WARRIOR AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

The examination and partial survey of the river from Tuscaloosa to its mouth, near Demopolis, was made in 1874.

The river was found to be adapted for high-water navigation only, with a boating season of an average duration of five months, from

December to May. During the season the depth ranged from 10 to 40 feet, and navigation was for the most part unobstructed, except from overhanging trees, which contracted the available width of the stream and occasionally wrecked the chimneys and damaged the upper works of steamboats. Below a 10 foot rise, snags became troublesome, and below 5 feet navigation practically ceased.

The improvement of the Warrior was authorized by act of Congress of March 3, 1875, and the project adopted was to deepen the bars by jetty construction, remove snags, and cut down overhanging trees, with a view to obtaining for small boats a low-water channel 80 feet wide by 4 feet depth.

The estimated cost of the improvement was $151,103.

Appropriations were made as follows:

Warrior and Tombigbee rivers:	
March 3, 1875	$25,000
August 14, 1876	15,000
June 18, 1878	28,000
March 3, 1879	20,000
Warrior River:	
June 14, 1880	20,000
March 3, 1881	10,622
August 2, 1882	10,000
July 5, 1884	12,000
August 5, 1886	18,750
August 11, 1888	18,000
September 19, 1890	45,000
July 13, 1892	75,000
Total	297,372

Of this amount $209,372 was appropriated for the Warrior, and $88,000 for Warrior and Tombigbee jointly.

The execution of the project was commenced in June, 1875, and continued for an average annual period of four months up to December 10, 1885, and for three months in 1887, the work being confined chiefly to the removal of snags and overhanging trees. Channel deepening by jetty construction was also attempted upon 49 of the bars affording the shoalest water, resulting in an increased depth of 1 to 1½ feet. In several of these cases the improvement was only temporary, owing mainly to bank erosion.

The slack-water improvement on the Black Warrior above Tuscaloosa, undertaken in 1888 to develop the Warrior coal fields, rendered it important that the perennial navigation contemplated by that improvement in order to be fully utilized should be extended to the gulf.

Accordingly a survey of the Warrior from Tuscaloosa to the mouth was authorized, and after some interruptions was completed in 1889, for the purpose of obtaining the data needed for submitting a project for securing a channel with a minimum low-water depth of 6 feet. A general plan for such a project requiring locks and dams has been proposed and is now under consideration. The work done since its resumption in 1891 has been carried on as a necessary preliminary to the slack-water project, viz, the removal of all obstructions of whatever nature from bank to bank to a depth of 6½ feet below the proposed slack-water surface, cutting all overhanging trees as well as heavy timber on bank slopes liable to slide, and straightening the channel through bars when the chutes were too narrow and crooked for barge navigation.

Work done during the fiscal year ending June 30, 1893, was as follows:

From the mouth up to Princes Ferry, 112¼ miles:

Snags pulled, cut up, and removed		2,423
Sunken logs removed		132
Stumps and logs leveled and blasted		116
Logs on banks cut up		143
Overhanging trees felled, pulled back, cut, and removed		4,128
Slip-ins removed		807
Sunken trees removed		254
Trees trimmed		59
Bushes cut		894
Trees deadened		1,165
Drifts removed		28
Fascines made		1,301
Dams built and raised		3
Stone taken out	cubic yards	147
Brush cut and loaded	cords	91

Work done during the fiscal year ending June 30, 1894, was as follows:

From Tuscaloosa to Parhams Reef, 59 miles below Tuscaloosa:

Trees cut		6,317
Trees deadened		280
Snags and stumps removed		6,039
Rock taken from reefs	yards	2,575
Gravel removed from bars	do	25,099
Linear feet of dams and jetties built		1,428
Trees cut and burned in clearing		4,167
Length of river worked over	miles	39

Rock reefs were removed at Hendricks Reef, Clements Reef, and Twelve-mile Rock, and partially below the bridge at Tuscaloosa. New channels were excavated through bars at Tuscaloosa, Tressels, Bald Bar, and Buzzard.

Money statement.

July 1, 1893, balance unexpended	$69,001.30
June 30, 1894, amount expended during fiscal year	34,294.06
July 1, 1894, balance unexpended	34,707.24
Amount (estimated) required for completion of existing project	457,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	250,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Articles.	1894.	1893.
	Tons.	*Tons.*
Cotton	700	705
Grain	1,250	675
Iron	25	20
Lumber	75	25
General merchandise	1,350	1,172
Total	3,400	2,597

TOMBIGBEE RIVER, FROM ITS MOUTH TO DEMOPOLIS.

Survey of this portion of the river was directed by the act of August 11, 1888. Report upon the survey was submitted December 24, 1889. The project proposed was to obtain a channel 6 feet deep at ordinary low water by the removal of snags, logs, and overhanging trees, dredging, bank revetment, and the construction of locks and dams. The length of this section of the river to be improved is 191 miles; the estimated cost is $508,808.

Appropriations for this work have been made as follows:

Act of—	
September 19, 1890	$55,000
July 13, 1892	125,000
Total	180,000

Actual operations were begun in July, 1891, and have been continued since whenever the stage of water permitted.

Operations prior to June 30, 1893, consisted in the preservation of the necessary plant, the removal of snags, logs, and overhanging trees from the entire river, rock blasting at McGrews Shoals, Pearsons Shoals, and Woods Bluff, and the repair of old jetties at Osage and Barneys shoals. The following work was performed:

Overhanging trees felled and removed		678
Snags and stumps removed from river		975
Old jetties repaired	linear feet	1,585
Rock blasted and excavated	cubic yards	2,944½
Material dredged (marl, clay, gravel, and sand)	do	1,772
Sunken barges removed		3

Operations during the fiscal year ending June 30, 1894, consisted in the removal of snags, logs, and overhanging trees accumulated since the river was previously cleared, dredging at Rainwater Bar and Barneys Shoals, repair of old jetties at Barneys Shoals, construction of shore protection and the repair of plant. The following work was performed:

Overhanging trees felled and removed		310
Snags and stumps removed from river		844
Old jetties repaired	linear feet	631
Material dredged (marl, clay, gravel, and sand)	cubic yards	19,142
Shore protection built	linear feet	257

The river is now navigable throughout nearly the entire year as far as Demopolis for the class of boats in operation upon it, but to keep it in this condition will require an annual expenditure of about $10,000 in addition to the amount expended in carrying out the original project.

No further permanent improvement can be obtained until the completion of the system of locks and dams included in the project.

Amount expended to June 30, 1894, $91,964.01, of which $1,550.07 was for the preservation of improvement already obtained.

Money statement.

July 1, 1893, balance unexpended	$111,216.86
June 30, 1894, amount expended during fiscal year	24,730.94
July 1, 1894, balance unexpended	86,485.92
Amount (estimated) required for completion of existing project	328,808.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	328,808.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

The total amount expended on the improvement up to June 30, 1894, was $44,012.24, of which about $16,718.59 was in preservation of the improvement. Of this amount a portion was taken from the appropriation made for the Tombigbee River from Fulton to Vienna and Tombigbee River above Columbus, which included this section.

Money statement.

July 1, 1893, balance unexpended	$2,806.53
June 30, 1894, amount expended during fiscal year	2,685.52
July 1, 1894, balance unexpended	121.01
Amount (estimated) required for preservation of improvement	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Downstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Cypress logs	450	$4,000	286	$1,716
Ash logs	400	4,000	200	2,000
Poplar logs	260	4,200	242	3,636
Oak logs	700	1,400	300	600
Pine logs	11,000	90,000	5,000	40,000
Total	12,810	103,600	6,028	47,952

TOMBIGBEE RIVER FROM WALKERS BRIDGE TO FULTON.

Examination was made under acts of March 3, 1881, and August 5, 1886.

The project adopted was the opening of a channel for high-water navigation from Fulton to Walkers bridge, by the removal of snags, logs, and overhanging trees, at an estimated cost of $11,000.

The following appropriations have been made:

By act of—	
August 11, 1888	$4,000
September 19, 1890	4,000
July 13, 1892	3,000
Total	11,000

Under these appropriations work was commenced at Fulton November 17, 1888, and continued at intervals up to June 30, 1891, and the project completed.

Work on the preservation of the improvement was commenced in September, 1892, and continued at intervals up to November, 1893.

The following obstructions were removed up to June 30, 1893:

Trees felled, pulled back, cut, and removed	5,579
Logs removed	1,085
Drift piles removed	17
Stumps leveled, blasted, and removed	1,013
Snags cut up and removed	258

COMMERCIAL STATISTICS.

Lower end of section.

Articles.	1894.	1893.
	Tons.	*Tons.*
Cotton	2,400	2,000
Grain	2,663	2,221
Iron	34	29
Lumber	7,022	5,950
General merchandise	7,450	5,622
Total	19,569	15,822

*Upper end of section.**

Articles.	1894.	
	Amount.	Value.
Cotton .... bales	1,200	$42,000
Cotton seed .... tons	130	1,170
General merchandise	....	30,000
Total	....	73,170

* Steamboat *City of Columbus* built at Columbus and began business during fiscal year. No river traffic previously.

TOMBIGBEE RIVER FROM FULTON TO COLUMBUS.

Survey was made under the act of June 10, 1872. Report submitted September 20, 1873.

The project adopted was to improve high-water navigation from Fulton to Columbus, 144 miles, by removal of all timber obstructions above low water, and to clear the banks of overhanging trees, at an estimated cost of $35,000.

Under appropriations for Tombigbee above Columbus and from Fulton to Vienna, the original project was completed at a cost of about $27,293.65.

Under the appropriation of $6,000 made by act of July 13, 1892, work was commenced at Fulton in December, 1892, and continued at intervals up to September, 1893, in preservation of improvement.

The following work was performed from July 13, 1892, up to June 30, 1893:

Stumps cut, leveled, and blasted	362
Snags cut and removed	160
Logs on banks cut up and removed	1,532
Overhanging trees felled, pulled back, cut and removed	5,773
Drift piles removed	54

The following work was performed during the fiscal year ending June 30, 1894:

Overhanging trees felled, pulled back, cut and removed	1,572
Logs on banks cut up	1,047
Stumps leveled, blasted, and removed	681
Drift piles removed	4

This work has resulted in clearing the river of the obstructions that have accumulated since the completion of the project from Fulton to the mouth of Old Town Creek, a distance of 74¾ miles.

The total amount expended on the improvement up to June 30, 1894, was $44,012.24, of which about $16,718.59 was in preservation of the improvement. Of this amount a portion was taken from the appropriation made for the Tombigbee River from Fulton to Vienna and Tombigbee River above Columbus, which included this section.

Money statement.

July 1, 1893, balance unexpended	$2,806.53
June 30, 1894, amount expended during fiscal year	2,685.52
July 1, 1894, balance unexpended	121.01
Amount (estimated) required for preservation of improvement	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Downstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Cypress logs	450	$4,000	286	$1,716
Ash logs	400	4,000	200	2,000
Poplar logs	260	4,200	242	3,636
Oak logs	700	1,400	300	600
Pine logs	11,000	90,000	5,000	40,000
Total	12,810	103,600	6,028	47,952

TOMBIGBEE RIVER FROM WALKERS BRIDGE TO FULTON.

Examination was made under acts of March 3, 1881, and August 5, 1886.

The project adopted was the opening of a channel for high-water navigation from Fulton to Walkers bridge, by the removal of snags, logs, and overhanging trees, at an estimated cost of $11,000.

The following appropriations have been made:

By act of—	
August 11, 1888	$4,000
September 19, 1890	4,000
July 13, 1892	3,000
Total	11,000

Under these appropriations work was commenced at Fulton November 17, 1888, and continued at intervals up to June 30, 1891, and the project completed.

Work on the preservation of the improvement was commenced in September, 1892, and continued at intervals up to November, 1893.

The following obstructions were removed up to June 30, 1893:

Trees felled, pulled back, cut, and removed	5,579
Logs removed	1,085
Drift piles removed	17
Stumps leveled, blasted, and removed	1,013
Snags cut up and removed	258

The following obstructions were removed during the fiscal year ending June 30, 1894:

Stumps leveled, blasted, and removed	316
Logs on banks cut up	590
Overhanging trees felled, pulled back, cut up, and removed	1,113

The condition of the river on June 30, 1894, is such as to allow large-sized rafts to be floated downstream on a 3-foot rise above low water, and barges of 4 feet draft on a 5-foot rise above low water.

The total amount expended on the improvement up to June 30, 1894, was $10,982.07, of which $3,390.96 was in preservation of the improvement.

Money statement.

July 1, 1893, balance unexpended	$1,129.41
June 30, 1894, amount expended during fiscal year	1,111.48
July 1, 1894, balance unexpended	17.93
Amount (estimated) required for completion of existing project	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	2,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Downstream.

Articles.	1894.	1893.
	Tons.	*Tons.*
Lumber and logs	12,500	8,250
Staves	52	28
Firewood	25	....

Q 4.

IMPROVEMENT OF NOXUBEE RIVER, MISSISSIPPI.

The examination of this river provided for by act of Congress approved March 3, 1879, was made during the month of March, 1880, and extended from Macon, Noxubee County, Miss., to the mouth of the river.

Report is contained in the Annual Report of the Chief of Engineers for 1880. The condition of the river when examined was such that during all seasons of the year and at all stages of water, navigation, except by small flatboats, was practically impossible. Prior to the building of the Mobile and Ohio Railroad (1859), steamboats plied the river. After the construction of this railroad the boats were withdrawn. The chief obstruction to navigation consisted in the immense number of trees overhanging the river throughout its entire length. At the time of the examination the minimum depth of the river was found to be (at ordinary low water) 1½ feet and the average width 60 feet.

The project adopted was to afford a navigable channel during high water, or for about five months, to the town of Macon by the removal of overhanging timber from the banks and such obstructions to navigation as might be found in the river.

The estimated cost was $65,245.25.

The appropriations made for this improvement are as follows:

By act of Congress—	
June 14, 1880	$12,000
March 3, 1881	8,000
August 2, 1882	10,000
July 5, 1884	7,500
August 5, 1886	7,500
August 11, 1888	5,000
September 19, 1890	3,000
July 13, 1892 (for maintenance)	3,000
Total	56,000

Work was commenced on the river during the low-water season of 1880 and was continued at intervals to October, 1889, and resulted in the completion of the project at a cost of $49,712.54.

Operations from November, 1889, to May, 1894, were confined to repairing and caring for the working plant and other public property.

The actual work of removing obstructions was resumed on May 1, 1894, and continued throughout the remainder of the fiscal year, 35 miles of the river from Macon downstream being cleared of the obstructions that had accumulated since the last work on the river. The following is a summary of the work performed:

Overhanging trees felled and removed	535
Logs on banks cut up	707
Piles of drift removed	9
Snags and stumps removed	510

The river is now and has been since October, 1889, navigable at high water up to Macon, but it will require an expenditure of $3,000 every year or so to maintain it in this improved condition.

During the year 1889 one boat made several trips up the river, but was then withdrawn, and no boats have since plied it, the railroads having lowered freight rates to such an extent as to keep all business away from the river. The value of the trade of Macon and vicinity is estimated at half a million dollars annually in each direction, and the saving in freight owing to the river being open at $20,000 each year.

The amount expended on the original project is	$49,712.54
The amount expended on maintenance up to June 30, 1894, is	4,350.09
Total	54,062.63

Money statement.

July 1, 1893, balance unexpended	$3,033.59
June 30, 1894, amount expended during fiscal year	1,096.22
July 1, 1894, balance unexpended	1,937.37
Amount (estimated) required for preservation of improvement	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	9,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Q 5.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

By act of—	
March 2, 1827, an appropriation was made of	$8,000
May 23, 1828, an appropriation was made of	17,500
August 30, 1852, an appropriation was made of	5,000

The first appropriation was made for removing obstructions from the river and deepening the channel at its mouth, the second one was made for deepening the channel at its mouth, and the third was made for a survey of the river. There are no records in this office of the work done under these appropriations.

In 1870, March 1, a canal (called Noyes Canal), dredged across the bar at the mouth of the river under a charter from the State of Mississippi to Abram A. Green, to a depth sufficient to admit vessels of 6 feet draft at low tide, was opened by private parties.

The cost of the canal has been stated to be $27,000, and for annual maintenance $4,000.

By the act of March 3, 1873, a survey was directed to be made at East Pascagoula Harbor, Mississippi Sound. This survey was made during the same year, and report was submitted October 23, 1873. The report is contained in the Annual Report of the Chief of Engineers for 1874. The plan adopted for the improvement was the dredging of a channel 200 feet wide and 7 feet deep at mean low water through the bar at the mouth of the river and the removal of snags and overhanging trees throughout its entire length, at an estimated cost of $53,800.

The following appropriations were made to carry out this project:

By act of—	
June 17, 1878	$10,000
March 3, 1879	14,000
June 14, 1880	20,000
March 3, 1881	4,000
August 2, 1882	8,000
July 5, 1884	3,000
Total	59,000

At the commencement of the work there was 3 feet on the crest of the bar at mean low water, and the river was much obstructed by snags, logs, and overhanging trees. Of the aggregate amount of the several appropriations made up to July 5, 1884, less $1,500 allotted for examination, $42,500 was devoted to dredging through the bar at the mouth, and resulted in securing a channel through the bar 180 feet to 190 feet wide, 7½ to 8 feet deep.

Fifteen thousand dollars of the amount appropriated up to that time was applied to the removal of snags, logs, and overhanging trees. Commencing at the light-house, near the mouth of the river, in the spring of 1882, the work was prosecuted during the working seasons of 1882, 1883, and 1884.

This portion of the work was completed on December 23, 1893, and resulted in securing a navigable channel from the mouth of the river to one-half mile above Dead Lake, 50½ miles, for vessels drawing 6½ feet, and to the junction of the Leaf and Chickasahay for vessels of lighter draft during six or eight months of the year. The project was then virtually completed.

By act of—	
August 5, 1886, an appropriation was made of	$20,000
August 5, 1886, transferred amount appropriated for improving Horn Island Pass, act of July 5, 1884	5,000
August 11, 1888, an appropriation was made of	27,000
September 19, 1890, an appropriation was made of	20,000
July 13, 1892, an appropriation of	20,000
Total	92,000

Under these appropriations a new project was proposed and approved for securing a channel of navigable width and minimum depth of 12 feet from Moss Point to the anchorage, in the Mississippi Sound, by dredging and construction of dam at Lowry Island under contract, at an estimated cost of $78,100, and maintaining the river above Moss Point in its improved condition by days' labor, at an annual cost of $2,500.

Statement of work done under the above appropriations.

Date of act.	Name of contractor.	Contract price measured in scow.	Cubic yards removed.	Commenced.	Completed.
		Cents.			
Aug. 5, 1886	J. H. Gardner	18.4	113,529	Oct. 8, 1887	Apr. 28, 1888
Aug. 11, 1888	George C. Fobes & Co	16.2	73,619	Apr. 16, 1890	July 30, 1890
Do	Alabama Dredging and Jetty Co.*				
Sep. 19, 1890	do	22	86,598	Feb. —, 1891	Sept. 25, 1891
July 13, 1892	do	18	99,977	Oct. 12, 1892	

Date of act.	Name of contractor.	Plant.		
		Apparatus.	Capacity of bucket.	Capacity of scows and character of material.
Aug. 5, 1886	J. H. Gardner	1 scoop dredge, 1 clam-shell dredge, 4 scows, 2 tugs.	2 cubic yards; 4 cubic yds.	70, 71, 274, and 441 cubic yards. Hard clay, sand, and little mud.
Aug. 11, 1888	Geo. C. Fobes & Co	1 clam-shell dredge, 2 scows, 2 tugs.	3½ cubic yards.	320, 334 cubic yards. Compact sand, little mud.
Do	Alabama Dredging and Jetty Co.			Hard clay, sand, and black mud.
Sept. 19, 1890	do	1 scoop dredge, 1 clam-shell dredge, 4 scows, 2 tugs.	2 cubic yards; 4 cubic yds.	143, 159, 323, and 489 cubic yards. Clay, little sand, and black mud.
July 13, 1892	do	2 clam-shell dredges, 4 scows, 2 tugs.	4 cubic yards; 4½ cubic yds.	274, 318, 441, and 489 cubic yards. Clay, compact sand, and black mud.

* Submerged dam at Lowry Island 270 linear feet, with wings (riprap), commenced May 1, 1890, and completed July 16, 1890, at a cost of $3,350.

Work on the river above Moss Point for preservation of improvement was commenced December 19, 1891, and continued at intervals to the end of July, 1893, from Moss Point up to Wilkinsons Ferry.

The following is a statement of work performed up to June 30, 1893:

Snags pulled and removed	479
Sunken logs and trees pulled and removed	157
Logs on banks cut up	210
Overhanging trees felled, pulled back, and cut up	1,551
Stumps leveled, blasted, and removed	101

The following is a statement of work done during fiscal year ending June 30, 1894:

Stumps removed	9
Snags removed from river	82

The extent and condition of the work was as follows June 30, 1893:

Extent.	Condition.
I. Snagging and cutting overhanging trees from head to mouth.	Complete, but needed reworking in preservation of improvement from Carters Landing up to head.
II. Dredging channel from Moss Point to mouth of navigable width and 12 feet depth, and construction of dam at Lowry Island.	Complete to a width of 80 feet, and in good condition when last examined. Dam completed.
III. Dredging channel of navigable width and 12 feet deep from the mouth to the 12-foot curve in Mississippi Sound, length of 18,898 feet.	Completed to a width of 80 feet for a distance of 6,112 feet, and to a width of 120 feet for a distance of 3,960 feet.

During the fiscal year ending June 30, 1894, $745.67 were expended, and resulted in the improvement of 32 miles of river from Carters Landing up to Wilkinsons Ferry.

Total amount expended on the improvement up to June 30, 1894, $91,966,40, of which $5,821.79 was in preservation of improvement.

The amount estimated for completion is in excess of the original estimate, the reasons for which are, that, owing to the extreme hardness of a portion of the bottom to be dredged and the smallness of the appropriations made available the cost of excavation is in excess of that originally estimated.

Money statement.

July 1, 1893, balance unexpended	$778.67
June 30, 1894, amount expended during fiscal year	745.07
July 1, 1894, balance unexpended	33.60
Amount (estimated) required for completion of existing project	49,000.00
Amount (estimated) for preservation of improvement above Moss Point from 1884 to 1894	22,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	71,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Q 6.

IMPROVEMENT OF CHICKASAHAY RIVER, MISSISSIPPI.

The act of Congress of August 11, 1888, provided for an examination of Chickasahay River, Mississippi, from its mouth to Enterprise, and report thereon was submitted on February 16, 1889.

The approved project was to clear the channel from its mouth to the railroad bridge near Shubuta, by the removal of logs, snags, and overhanging trees, at an estimated cost of $30,000.

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
Total	10,000

Under these appropriations work was commenced on October 13, 1891, and continued at intervals up to December 28, 1893.

The following is a statement of work performed up to June 30, 1893:

Snags cut up, trimmed, and removed	8,890
Stumps leveled, blasted, and removed	1,025
Overhanging trees felled, pulled back, cut up, and removed	7,229
Trees trimmed	5,832
Logs on banks cut up	15,075
Brushes cut	12,810
Rock blasted and excavated ... cubic yards	28
Clay excavated and removed ... do	12

The following is a statement of work performed during the fiscal year ending June 30, 1894:

Snags cut up, trimmed, blasted, and removed	2,826
Stumps leveled, blasted, and removed	112
Logs on banks cut up	114
Overhanging trees felled, pulled back, cut up, and removed	1,354

The work has resulted in the improvement of 22¾ miles of river, from the mouth up to Crawfords Landing, in accordance with the original project. From Crawfords Lake to Waynesboro the river has been only partially improved and requires reworking.

No work has as yet been done above Waynesboro.

The condition of the river on June 30, 1894, is such as to give a much better high-water channel from Waynesboro down to the mouth, allowing much larger rafts and small boats to run on a 4 or 5 foot rise above ordinary low water

Money statement.

July 1, 1893, balance unexpended	$3, 553. 54
June 30, 1894, amount expended during fiscal year	3, 513. 25
July 1, 1894, balance unexpended	40. 29

Amount (estimated) required for completion of existing project	20, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Vessels employed.

One small stern-wheel steamboat makes occasional trips between Scranton and Waynesboro, Miss.

Upstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
General merchandise, grain, etc	10	$15, 000		

Downstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Cotton	12	$2, 400		
Produce	1	150		
Lumber and saw logs	8, 000	250, 000	6, 394	$210, 400
Total	8, 013	252, 550	6, 394	210, 400

Q 7.

IMPROVEMENT OF LEAF RIVER, MISSISSIPPI.

The act of Congress of August 11, 1888, provided for an examination of Leaf River from its mouth to mouth of Bowie Creek, near the New Orleans and North Eastern Railroad, and report thereon was submitted February 15, 1889.

The approved project was to clear the channel from its mouth to Bowie Creek for high-water navigation by the removal of snags, logs, and overhanging trees at an estimated cost of $25,000.

The following appropriations have been made:

By act of—	
September 19, 1890	$5, 000
July 13, 1892	5, 000
Total	10, 000

Under these appropriations work was commenced during August, 1891, and continued at intervals up to December 23, 1893.

The following is a statement of work performed up to June 30, 1893:

Snags pulled and cut up	1,475
Sunken logs and trees removed	110
Overhanging trees felled, pulled back, cut up, and removed	2,243
Logs on banks cut up	273
Stumps leveled, blasted, and removed	364
Trees trimmed	143
Bushes cut and removed	1,760

The following is a statement of work performed during the fiscal year ending June 30, 1894:

Snags cut up, trimmed, and removed	606
Stumps leveled, blasted and removed	5,048
Logs on banks cut up	2,418
Overhanging trees cut, felled, pulled back, and removed	3,561
Trees trimmed	1,208
Drift piles removed	53

This work has resulted in giving a high-water channel from Hattiesburg, Miss., to the mouth, a distance of 75 miles, of which 60 miles from the mouth up to Choctaw Bluff have been improved according to project and 15 miles, from Choctaw Bluff to Bowie Creek, were only partially improved and require reworking.

This work will not be permanent. An annual expenditure of $1,500 will be required to maintain the river in the condition contemplated by the project.

Total amount expended on the improvement up to June 30, 1894, $9,209.39, of which $2,617.27 was in preservation of improvement.

Money statement.

July 1, 1893, balance unexpended	$4,874.22
June 30, 1894, amount expended during fiscal year	4,083.61
July 1, 1894, balance unexpended	790.61
Amount (estimated) required for completion of existing project	15,000.00
Amount (estimated) for preservation of improvement	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	16,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Vessels employed.

One small stern-wheel steamer makes an occasional trip up the river.

Upstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
General merchandise	40	$40,000	25	$25,000

Downstream.

Articles.	1894. Tons.	1894. Value.	1893. Tons.	1893. Value.
Saw logs, hewn timber	50,000	$450,000	52,064	$355,400
Lumber	20,000	15,000		
Total	70,000	465,000	52,064	$355,400

Q 8.

IMPROVEMENT OF HARBOR AT BILOXI BAY, MISSISSIPPI.

The examination of this harbor, provided for by the third section of the river and harbor act of March 3, 1881, was made during the months of August and September, 1881.

The report is contained in Annual Report of Chief of Engineers, 1882, Appendix K 27.

The following appropriations have been made by Congress:

Act of—	
August 2, 1882	$5,000
August 5, 1886	12,500
August 11, 1888	18,500
September 19, 1890	9,000
Total	45,000

The original project, adopted in 1882, was to dredge a channel through the Deer Island Flats, to connect Biloxi Bay with the Back Bay of Biloxi, of navigable width and 8 feet depth, the existing depth being 4 feet, at an estimated cost of $35,000.

This project was changed in 1884 to deepening the channel from Mississippi Sound to the wharves of Biloxi to 8 feet, existing depth being 4½ feet, in accordance with the terms of the act of July 5, 1884, and the estimated cost was $55,000.

Work was commenced September 12, 1887, and continued under the following contracts to August 22, 1893.

Statement of the work under the appropriations made.

Date of act.	Name of contractor.	Contract price measured in scows, cubic yards.	Cubic yards removed.	Commenced.	Completed.	Remarks.
1882. Aug. 2 1886. Aug. 5	Geo. C. Fobes & Co.	*Cents.* .17	84,686	Sept. 12, 1887	Mar. 2, 1888	Soft black mud, little sand, clamshell dredge, 1 tug, 2 scows.
1888. Aug. 11	Alabama Dredging and Jetty Co.	.14⅜	97,092	July 14, 1890	Nov. 12, 1890	Distance to dumping ground, 1½ to 2½ miles.
1890. Sept. 19	....do	.18	53,423	Dec. 28, 1892	Aug. 22, 1893	

The project was successfully completed in 1892, at a cost of $34,148.64.

The last appropriation was expended in improving the channel and removing a slight fill that had taken place in the lower part.

At the last examination, made in August, 1893, the condition of the channel was found to be as follows: Minimum width 160 feet, minimum depth 9 feet.

Money statement.

July 1, 1893, balance unexpended	$8,624.16
June 30, 1894, amount expended during fiscal year	7,912.31
July 1, 1894, balance unexpended	711.85

Q 9.

IMPROVEMENT OF PEARL RIVER BELOW JACKSON, MISSISSIPPI.

The original project was adopted in 1880, and was to afford a channel of navigable width and 5 feet deep at low water from Jackson, Miss., to the mouth, at an estimated cost of $95,940.

In 1885 the original project was changed so as to obtain a channel 2 feet deep, and the estimate was increased $50,000.

In addition to the improvement of the river it was proposed to dredge a channel 12 feet deep at mean low water through the bar at the mouth of East Pearl River, at an estimated cost of $20,000.

The following appropriations have been made:

By act of—		By act of—	
June 14, 1880	$30,000	August 11, 1888	$15,000
March 3, 1881	25,000	September 19, 1890	20,000
August 2, 1882	15,000	July 13, 1892	15,000
July 3, 1884	10,000		
August 5, 1886	13,125	Total	143,125

Under these appropriations work was commenced in December, 1880, and continued at intervals up to December, 1893.

One hundred and six miles of the river from the mouth up were improved according to project, and the balance, up to Jackson, 209 miles, were partially improved.

The following is a statement of the total work performed up to June 30, 1893:

Snags removed	8,257
Roots removed	6,808
Sunken logs removed	5,372
Sunken trees removed	3,037
Stumps removed	2,305
Knees removed	37
Standing trees removed	1,693
Overhanging trees felled, pulled back, cut, and removed	32,912
Logs on banks cut up	125
Trees deadened	2,936
Trees trimmed	74
Brushes cut	1,117
Drift piles removed	61
Sand and clay removed, cubic yards	11,739¼
Cane cut and removed, running yards	9,422
Piles driven for jetty work	256
Willows planted; jetty work, cords	696
Trees felled, moved, and sunk for jetty work	1,531
Sunken logs and trees pulled for jetties	116
Willows cut and made into mattresses for jetties, cords	618¼
Clay dug, transported, and wheeled and sunk for jetties, cubic yards	3,220

The following is a statement of work performed during the fiscal year ending June 30, 1894.

Snags pulled and removed	960
Stumps cut, leveled, blasted, and removed	133
Logs on banks cut up	290
Drift piles removed	62
Overhanging trees felled, pulled back, cut, and removed	10,538
Brushes cut	968

The condition of the river on June 30, 1894, is such as to allow light-draft boats to navigate from the mouth to Wheats Fields, 106 miles, all the year, completing that portion according to project.

From Wheats Fields to Jackson, 209 miles, the river has only been partially improved.

The reduction in freights and insurance due to river improvement is considerable.

Total amount expended on the improvement up to June 30, 1894, $124,527.44, of which $21,457.11 was in preservation of improvement.

Money statement.

July 1, 1893, balance unexpended	$22,960.44
June 30, 1894, amount expended during fiscal year	4,362.88
July 1, 1894, balance unexpended	18,597.56
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Vessels employed.

Description.	1894.		1893.	
	No.	Tons.	No.	Tons.
Steamboats	11	1,400	11	1,400
Schooners	61	5,000	61	5,000
Lighters and flatboats	22	1,300	22	1,300
Total	94	7,700	94	7,700

Upstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Fertilizers	1,500	$38,250	1,600	$40,000
Grain	2,000	42,000	1,900	35,000
Machinery, furniture, etc	750	37,500	500	25,000
General merchandise	1,500	40,000	1,300	35,100
Total	5,750	157,750	5,300	135,100

Downstream.

Cotton	230	$165,000	200	$140,000
Produce	60	2,500	80	3,000
Rice	2	1,200		
Turpentine	60	4,200	45	3,600
Resin	200	4,000	180	3,000
Staves	20	4,000	8	1,520
Wool	10	6,000	15	9,000
Firewood	160	2,200	125	1,500
Fowls and eggs	5	2,500		
Saw logs, pine	166,000	600,000	140,000	560,000
Saw logs, cypress	800	58,000	500	40,000
Lumber, foreign	40,000	530,000	33,000	435,000
Lumber, coastwise	12,000	152,000	10,500	145,000
Charcoal	50	1,500	40	1,342
Total	218,597	1,533,100	185,173	1,342,800

Q 10.

IMPROVEMENT OF PEARL RIVER BETWEEN CARTHAGE AND JACKSON, MISSISSIPPI.

The original condition of this portion of the river was such as to permit navigation only during high water, and even then it was difficult and dangerous.

An examination of this part of the river was made in 1879, and report thereon is contained in the Annual Report of the Chief of Engineers of 1879 (Appendix K 2).

The original project was to afford a clear channel of navigable width and 5 feet deep at low water from Carthage to Jackson, a distance of 105 miles, at an estimated cost of $21,000.

In 1886 the depth to be obtained was reduced to 2 feet, and the estimate was increased $29,000.

The following appropriations have been made:

By act of—		By act of—	
March 3, 1879	$6,000	August 11, 1888	$2,500
June 14, 1880	7,500	September 19, 1890	3,000
March 3, 1881	2,500	July 13, 1892	5,000
August 2, 1882	2,500		
August 6, 1886	2,250	Total	31,250

Under these appropriations work was commenced November 20, 1879, and continued at intervals up to January, 1894.

The following is a statement of work performed up to June 30, 1893:

Snags cut up, trimmed, and removed	40,850
Stumps cut, leveled, and blasted	2,033
Logs on banks cut up	1,833
Sunken logs cut up and removed	5,184
Sunken trees cut up and removed	793
Drift piles removed	8
Overhanging trees cut, felled, pulled back, and removed	4,896
Trees trimmed	282
Bushes cut	11,205

The following is a statement of the work performed during the fiscal year ending June 30, 1894:

Snags cut up, trimmed, and removed	37,555
Stumps cut, leveled, and blasted	1,873
Logs on banks cut up	7,946
Piles of drift removed	50
Overhanging trees cut, felled, pulled back, and removed	12,231
Trees trimmed	2,233
Bushes cut	29,821

The project is completed. The present work is for the preservation of the improvement, for which $2,400 will be required annually.

The condition of this portion of the river is such as to allow light-draft boats to navigate safely on a 3-foot rise above ordinary low water from Carthage down to Jackson.

Total amount expended on the improvement up to June 30, 1894, $29,741.92, of which $3,726.94 was in preservation of improvement.

The reduction in freights and insurance due to river improvement is considerable.

Money statement.

July 1, 1893, balance unexpended	$4,997.51
June 30, 1894, amount expended during fiscal year	3,489.43
July 1, 1894, balance unexpended	1,508.08
Amount (estimated) required for preservation of improvement	4,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	4,800.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Vessels engaged on the river.

Class.	1894.			1893.		
	Length.	Draft.	Tonnage.	Length.	Draft.	Tonnage.
	Feet.	*Feet.*		*Feet.*	*Feet.*	
One stern-wheel steamboat	110	3	90	110	3	90
One propeller steamboat	40	3	50	40	3	50
Six flatboats	50	1½	250	50	1½	250

Upstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
General merchandise	800	$85,000	750	$75,000
Grain	200	5.000	120	4,800
Fertilizers	300	7,500	200	5,000
Machinery and furniture	20	4,000	12	1,200
Total	1,320	101,500	1,082	86,000

Downstream.

	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Cotton	400	$80,000	325	$65,000
Staves	100	2,900	37	1,800
Lumber	60	580	35	276
Shingles	10	50	....	....
Firewood	900	1,500	756	900
Saw logs	1,500	25,000	1,055	19,000
Produce	25	1,200	20	1,000
Wool	23	12.000	13	7,800
Total	3,018	123,230	2,241	95,776

Q 11.

IMPROVEMENT OF PEARL RIVER, MISSISSIPPI, BETWEEN EDINBURG AND CARTHAGE.

A survey was made of this part of Pearl River during November, 1883, and report thereon is contained in the Annual Report of the Chief of Engineers of 1884 (Appendix Q 18).

The original project was to afford a high-water channel from Edinburg to Carthage, a distance of 24¾ miles, for six or eight months of the year, at an estimated cost of $13,464.

The following appropriations have been made:

By act of—	
July 5, 1884	$2,500
August 5, 1886	2,500
August 11, 1888	5,000
September 19, 1890	5,000
July 13, 1892	500
Total	15,500

Under these appropriations work was commenced on November 17, 1884, and continued at intervals up to February, 1893.

The following is a statement of the total work performed up to the end of fiscal year ending June 30, 1894:

Snags, stumps, logs, and trees, cut up and trimmed	157,909
Standing trees cut and removed	368
Stumps blasted and removed	1,257
Logs on banks cut up	1,637
Fallen trees removed	94
Overhanging trees cut, pulled back, and removed	21,701
Trees trimmed	1,236
Bushes cut	50,115
Banks cleared of brush ....yards	6,491
Drift piles removed	40

The condition of this portion of the river on June 30, 1894, was such as to allow light-draft boats to navigate safely from Edinburg to Carthage on a 4-foot rise above ordinary low water.

Total amount expended on the improvement up to June 30, 1894, $14,741.35, of which $4,078.86 was in preservation of improvement.

The present work is for preservation of the improvement, for which $500 will be required annually.

The reduction in freights and insurance due to river improvement is considerable.

Money statement.

July 1, 1893, balance unexpended	$522.41
June 30, 1894, amount expended during fiscal year	13.76
July 1, 1894, balance unexpended	508.65
Amount (estimated) required for preservation of improvement	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Vessels employed.

Description.	1894.				1893.			
	Number.	Length.	Draft.	Tonnage.	Number.	Length.	Draft.	Tonnage.
		Feet.	*Feet.*			*Feet.*	*Feet.*	
Stern-wheel steamer	1	100	3	90	1	100	3	90

Upstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
General merchandise, grain, fertilizers, furniture, and machinery	600	$55,000	570	$50,000

Downstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Cotton, wool, and country produce	300	$40,000	250	$35,000

Q 12.

IMPROVEMENT OF BOGUE CHITTO, LOUISIANA.

Examination of this river was made by direction of act of Congress of August 11, 1888, and report submitted June 24, 1889.

The original project was to close the west mouth and to remove snags, logs, overhanging trees, and fish-traps from the east mouth up to Alfords bridge, a distance of 190 miles, so that the river could be used by small river steamers the greater part of the year, at an estimated cost of $55,000.

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
Total	10,000

Under these appropriations work was commenced in August, 1893, and continued up to December 23, 1893.

The following is a statement of work performed during the fiscal year ending June 30, 1894:

Snags pulled and removed	1,441
Stumps cut, leveled, and blasted	193
Logs on banks cut up	78
Overhanging trees felled, cut, pulled back, and removed	4,559
Bushes cut	4,965
Drift piles removed	25
Sand removed at mouth ..... cubic yards	150
Willow mattresses made and sunk	1,162

Eighteen miles of river, from the mouth up, were improved according to project, and the east mouth has been opened so as to allow light-draft boats to pass at a 3-foot rise above low water.

Money statement.

July 1, 1893, balance unexpended	$6,927.60
June 30, 1894, amount expended during fiscal year	4,551.80
July 1, 1894, balance unexpended	2,375.80
Amount (estimated) required for completion of existing project	45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Downstream.

Articles.	1894.		1893.	
	Tons.	Value.	Tons.	Value.
Saw logs, pine	9,000	$50,000	5,100	$29,600
Saw logs, cypress	6,000	25,000	....	....
Hewn timber	5,600	55,000	1,584	13,200
Total	20,600	130,000	6,684	42,800

Q 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

REMOVAL OF SUNKEN DRY DOCK IN MOBILE RIVER, ALABAMA.

April 11, 1893, authority was requested to remove wreck of sunken dry dock in Mobile River, Alabama, which was granted, and an allotment of $3,000 made for that purpose from the permanent, indefinite appropriation for "removing sunken vessels or craft obstructing or endangering navigation," act of June 14, 1880, to pay attendant expenses of the work.

Advertisements inviting proposals for the removal of the sunken dry dock were published May 25, 1893; proposals opened June 26, 1893.

The lowest bid, that of John Hogan, $8,250, being considered too high, was rejected.

Bids were again solicited, opened October 14, 1893, and contract awarded to W. H. Brown, at $2,500, work to commence November 20, 1893, and be completed January 20, 1894. Extension granted to March 2, 1894, again to April 1, and again to May 10, 1894, at which time the work was not completed, and was abandoned by the contractor, after removing arches, machinery, top and greater portion of sides and ends, leaving ballast, entire bottom, part of sides and ends to be removed.

The amount expended during the year upon removal of wrecks is $615.57.

INDEX.

[The references in Roman are to part (or volume), and those in Arabic to page.]

A.

Acacia (schooner), removal of wreck of ... i, 62, 611
Agate Bay, Minn., improvement of harbor at ... i, 308; iv, 2011
Ahnapee and Western Railway Company, bridge of ... i, 428
Ahnapee Harbor, Wis., improvement of ... i, 321; iv, 2064
Aitken, Kate V. (schooner), removal of wreck of ... i, 174; ii, 1128
Akers, Annie W. (schooner), removal of wreck of ... i, 63, 614
Alabama River, Ala.:
    Bridge near Montgomery, construction of ... i, 425
    Improvement of ... i, 205; ii, 1277
Alameda Harbor, Cal., establishment of harbor lines ... i, 424; iv, 2505
Albemarle Sound, N. C., improvement of waterway between Norfolk Harbor and ... i, 151; ii, 983
Allegheny River, Pa.:
    Bridge at Creighton, construction of ... i, 428
    Bridge below Tarentum, construction of ... i, 428
    Dam at Herr Island, construction of ... i, 292; iii, 1918
    Improvement of ... i, 292; iii, 1913
Alloway Creek, N. J., improvement of ... i, 116; ii, 855
Alma (vessel), removal of wreck of ... i, 62, 609
Alpena Harbor, Mich., improvement of ... i, 354; iv, 2241
Altamaha River, Ga., improvement of ... i, 178; ii, 1169
Alva (steam yacht), removal of wreck of ... i, 62, 604
Amite River, La., improvement of ... i, 222; iii, 1354
Anacostia River, D. C., improvement of ... i, 138; ii, 939
Anderson, Eliza (schooner), removal of wreck of ... i, 82, 712
Anderson, G. W. (steamer), removal of wreck of ... i, 232; iii, 1383
Ann, Cape, Mass., improvement of harbor of refuge at Sandy Bay ... i, 39, 536
Apalachicola Bay, Fla., improvement of ... i, 196; ii, 1249
Apalachicola River, Fla., improvement of ... i, 197; ii, 1252
Appomattox River, Va., improvement of ... i, 149; ii, 981
Appoquinimink River, Del., improvement of ... i, 119; ii, 875
Aquia Creek, Va., improvement of ... 139; ii, 944
Arkansas River:
    Bridge at Little Rock, Ark., construction of ... i, 425
    Improvement of ... i, 252; iii, 1531
    Removing obstructions in ... i, 251; iii, 1529
Arthur Kill, N. Y. and N. J., improvement of ... i, 97, 798
Arthur, Lake, La., improvement of ... i, 227; iii, 1372
Ashland, Wis., improvement of harbor at ... i, 311; iv, 2023
Ashley River, S. C.:
    Improvement of ... i, 172; ii, 1114
    Removal of wreck in ... i, 174; ii, 1128
Ashtabula Harbor, Ohio:
    Improvement of ... i, 376; iv, 2420
    Removal of wreck off ... i, 378; iv, 2426
Assateague Bay, Va., removal of wreck off Popes Island ... ii, 907
Assistants to the Chief of Engineers ... i, 444
Atlantic and North Carolina Railroad Company, bridge of ... i, 431
Atlantic Ocean, removal of wreck off Southampton, N. Y ... i, 82, 713
Augusta, Ga., bridge across Savannah River near, protection of, etc ... i, 429

B.

Back Cove, Portland, Me., improvement of channel in........................ I, 31, 517
Bagaduce River, Me., improvement of .... I, 24, 498
Baltimore and Ohio Railroad Company, bridge of.............................. I, 435
Baltimore Harbor, Md.:
    Defense of .... I, 6, 14
    Improvement of channel to .... I, 132; II, 909
    Improvement of channel to Curtis Bay .... I, 133; II, 914
    Sea walls at .... I, 14
Bar Harbor, Me. construction of breakwater from Mount Desert to Porcupine
        Island .... I, 23, 496
Barber, G. (schooner), removal of wreck of................................ IV, 2124
Barmore, E. H. (steamer), removal of wreck of.................... I, 232; III, 1383
Barnegat Light, N. J., removal of wreck opposite................... I, 117; II, 861
Barren River, Ky., operating and care of lock and dam on.......... I, 302; III, 1972
Bartholomew, Bayou, La. and Ark., improvement of.................. I, 242; III, 1471
Bass River, Mass., removal of wreck near .... I, 63, 620
Battalion of Engineers... I, 17, 469
Batteries.. I, 5, 11, 12
Bay Ridge Channel, New York Harbor, N. Y., improvement of.................. I, 91, 764
Bearses Shoal, Mass., removal of wrecks on............................ I, 63, 616, 617
Beaufort Harbor, N. C.:
    Improvement of .... I, 160; II, 1031
    Improvement of waterway between Newbern (on Neuse River) and. I, 159; II, 1030
    Improvement of waterway between New River and.................. I, 161; II, 1034
Beaufort River, S. C., improvement of .... I, 174; II, 1125
Beaver River, Pa., dam in Ohio River below .... I, 287; III, 1870
Bedloes Island, N. Y., sea wall at .... I, 14
Belfast Harbor, Me., improvement of .... I, 26, 503
Bellaire, Ohio, establishment of harbor lines in Ohio River....... I, 423; III, 1894
Bellamy River, N. H., improvement of.. I, 34, 523
Benton Harbor, Mich., improvement of harbor at (St. Joseph Harbor). I, 339; IV, 2192
Bergen County, N. J., construction of bridge across Passaic River at Passaic
        by .... I, 128
Bernard, Edith (schooner), removal of wreck of .... I, 152; II, 987
Big Black River, Miss.:
    Bridge at Hankinsons Ferry, construction of .... I, 430
    Improvement of... I, 244; III, 1482
Big Hatchee River, Tenn., improvement of .... I, 249; III, 1516
Big Pigeon Bayou, La., removal of wreck in .... I, 232; III, 1383
Big Sandy River, W. Va. and Ky.:
    Improvement of .... I, 305; III, 1992
    Improvement of Levisa Fork of, Ky.............................. I, 305; III, 2001
    Improvement of Tug Fork of..................................... I, 306; III, 2002
Big Sunflower River, Miss., improvement of........................ I, 248; III, 1513
Bills for bridges, examination of .... I, 20
Biloxi Bay, Miss., improvement of harbor at....................... I, 216; II, 1325
Biloxi Harbor, Miss., improvement of .... I, 216; II, 1325
Black Lake Harbor, Mich., improvement of .... I, 343; IV, 2206
Black River, Ark. and Mo., improvement of......................... I, 254; III, 1555
Black River, La., improvement of .... I, 241; III, 1455
Black River, Mich.:
    Improvement of, at Port Huron .... I, 358; IV, 2251
    Improvement of mouth of.. I, 358; IV, 2253
Black River, N. C., improvement of .... I, 163; II, 1042
Black River Harbor, Ohio, improvement of.......................... I, 374; IV, 2405
Black Rock Harbor, Conn., improvement of.................................... I, 72, 663
Black Warrior River, Ala.:
    Improvement of (below Tuscaloosa).............................. I, 212; II, 1311
    improvement of, between Tuscaloosa and Daniels Creek........... I, 211; II, 1310
Block Island, R. I., improvement of harbor of refuge at..................... I, 59, 597
Block Island Sound, R. I., removal of wreck in.............................. I, 82, 711
Blood River, La., improvement of.................................. I, 221; III, 1352
Board of Engineers, The:
    Members .... I, 15
    Members, additional duties of... I, 16
    Personal examinations .... I, 16
    Reports, summary of .... I, 15
Board on Fortifications or other Defenses.................................... I, 4

Bœuf River, La., improvement of ..... I, 243; III, 1475
Bogue Chitto, La., improvement of ..... I, 218; II, 1331
Bogue Falia, La., improvement of ..... I, 220; III, 1349
Booth Brothers (schooner), removal of wreck of ..... I, 117; II, 861
Boston, Mass., bridge across Chelsea Creek, by city of, reconstruction of ..... I, 428
Boston Harbor, Mass.:
  Defense of ..... I, 5, 6, 7
  Grovers Cliff, site for fortification ..... I, 13
  Improvement of ..... I, 44, 549
Boyds Ferry, Tenn., construction of bridge across Holston River ..... I, 427
Bradford, Mass., alteration of city bridge obstructing Merrimac River between Haverhill and ..... I, 430
Brandywine Creek, Del., removal of wreck in ..... I, 132; II, 907
Brazoria County, Tex.:
  Construction of bridge across Brazos River by ..... I, 428
  Construction of bridge across San Bernard River by ..... I, 426
Brazos River, Tex., construction of bridge at Columbia ..... I, 428
Brazos Santiago, Tex., improvement of harbor at ..... I, 237; III, 1413
Breakwaters built by the United States, occupancy or injury of ..... I, 20, 431; VI, 3189
Breeze, Point, Schuylkill River, removal of wreck below ..... I, 118; II, 862
Bridesburg, Pa., removal of wreck in Delaware River at ..... I, 117; II, 861
Bridgeport Harbor, Conn., improvement of ..... I, 71, 659
Bridges:
  Construction of, across navigable waters ..... I, 20, 424
  Examination of bills of Congress for ..... I, 20
  Examination of plans and locations of proposed ..... I, 20, 424
  Obstructing navigation, action upon ..... I, 20, 430
Brigantine Shoal, N. J., removal of wreck from ..... I, 117; II, 861
Bristol County, Mass., construction of bridge across East Branch of Westport River at Westport Point by ..... I, 429
Broad Creek River, Del., improvement of ..... I, 128; II, 897
Broadkiln River, Del., improvement of ..... I, 123; II, 883
Browns Creek, Sayville, N. Y., improvement of ..... I, 81, 708
Browns Ledge, Mass., removal of wreck near ..... I, 63, 619
Brunswick Harbor, Ga.:
  Improvement of ..... I, 180; II, 1187
  Improvement of outer bar at ..... I, 180; II, 1193
Buffalo, N. Y.:
  Improvement of channels in connecting waters of Great Lakes between Chicago, Duluth, and ..... I, 361; IV, 2261
  Improvement of harbor at ..... I, 380; IV, 2438
Buffalo Bayou, Tex.:
  Bridge at Houston, construction of ..... I, 428
  Improvement of ..... I, 237; III, 1409
Burlington Harbor, Vt., improvement of ..... I, 390; IV, 2496
Buttermilk Channel, New York Harbor, N. Y., improvement of ..... I, 90, 761

C.

Cable galleries ..... I, 6
Cache River, Ark., improvement of ..... I, 254; III, 1554
Cahaba River, Ala., improvement of ..... I, 209; II, 1298
Calcasieu River, La., improvement of mouth and passes of ..... I, 228; III, 1373
California:
  Department of, report of engineer officer ..... I, 443; VI, 3453
  Hydraulic mining and mining débris in ..... I, 421; VI, 3169
California Débris Commission ..... I, 421; VI, 3169
Caloosahatchee River, Fla., improvement of ..... I, 190; II, 1233
Calumet Harbor, Ill., improvement of ..... I, 332; IV, 2138
Calumet River, Ill. and Ind.:
  Bridge at South Chicago, alteration of ..... I, 430
  Bridge at South Chicago, construction of ..... I, 425
  Improvement of ..... I, 333; IV, 2143
Cambridge, Md., construction of bridge across Cambridge Harbor at ..... I, 429
Cambridge Harbor, Md.:
  Construction of bridge across, at Cambridge ..... I, 429
  Improvement of ..... I, 128; II, 895
Camden Harbor, Me., improvement of ..... I, 26, 505
Camden Harbor, N. J.:
  Establishment of harbor lines ..... I, 423; II, 864
  Improvement of ..... I, 108, 110; II, 827, 836

Canals, etc.:
  Allegheny River, construction of dam at Herr Island, Pa.......... I, 292; III, 1918
  Barren and Green rivers, Ky., operating and care of locks and dams on .... I, 302; III, 1972
  Big Sandy River, construction of lock and dam near Louisa, Ky. I, 305; III, 1982
  Chincoteague Bay, construction of temporary bridge across canal connecting Delaware Bay and .... I, 430
  Clubfoot and Harlowe Canal, improvement of waterway via ..... I, 159; II, 1030
  Columbia River, Oreg., construction of Cascades Canal........... I, 415; IV, 2645
  Coosa River, Ga. and Ala., operating and care of locks and dams on. I, 208; II, 1297
  Cumberland River, Tenn. and Ky., construction of locks and dams on .... I, 278; III, 1804
  Fox River and canal, Wis., construction of bridge across, at De Pere....... I, 427
  Fox River and canal, Wis., construction of bridge across, at Kaukauna.... I, 427
  Fox River, Wis., construction of bridge across lock of canal at Little Chute. I, 429
  Fox River, Wis., operating and care of locks and dams on........ I, 330; IV, 2111
  Galena River, Ill., operating and care of .... I, 263; III, 1691
  Great Kanawha River, W. Va., construction of locks and dams on. I, 297; III, 1951
  Great Kanawha River, W. Va., operating and care of locks and dams on .... I, 299; III, 1962
  Green River, Ky., construction of Lock No. 5 .... I, 302; III, 1971
  Green River, Ky., reconstruction of Lock No. 2 at Rumsey .... I, 302; III, 1968
  Green and Barren rivers, Ky., operating and care of locks and dams on .... I, 302; III, 1972
  Illinois and Mississippi Canal, Ill., construction of .... I, 336; IV, 2162
  Illinois River, Ill., operating and care of La Grange and Kampsville locks and dams .... I, 335; IV, 2159
  Kentucky River, Ky., construction of locks and dams on .... I, 303; III, 1960
  Kentucky River, Ky., operating and care of locks and dams on.. I, 304; III, 1963
  Keweenaw Point, Mich., improvement of waterway from Lake Superior to Keweenaw Bay .... I, 312; IV, 2029
  Keweenaw Point, Mich., operating and care of waterway from Lake Superior to Keweenaw Bay .... I, 313; IV, 2029
  Little Kanawha River, W. Va., operating and care of lock and dam on .... I, 307; III, 2007
  Mississippi River, construction of locks and dams between Minneapolis and St. Paul, Minn.. III, 1640, 1681
  Mississippi River, operating and care of Des Moines Rapids Canal and dry dock .... I, 263; III, 1684
  Monongahela River, construction of locks and dams on........... I, 290; III, 1903
  Monongahela River, operating and care of locks and dams Nos. 8 and 9 .... I, 291; III, 1906
  Monongahela River, purchase of Lock and Dam No. 6............. I, 291; III, 1911
  Monongahela River, purchase of Lock and Dam No. 7............. I, 291; III, 1911
  Muskingum River, Ohio, operating and care of locks and dams on I, 289; III, 1876
  Ohio River, below Beaver River, Pa., construction of dam....... I, 287; III, 1870
  Ohio River, location of Dam No. 2 .... I, 287
  Ohio River, operating and care of Davis Island Dam............. I, 287; III, 1867
  Ohio River, operating and care of Louisville and Portland Canal I, 295; III, 1935
  St. Clair Flats Canal, Mich., improvement of..................... I, 365; IV, 2371
  St. Clair Flats Canal, Mich., operating and care of............... I, 366; IV, 2373
  St. Marys Falls Canal, Mich., operating and care of............... I, 363; IV, 2267
  St. Marys Falls Canal, Mich., water levels .... I, 441; VI, 3319, 3430
  Sturgeon Bay and Lake Michigan Ship Canal, Wis., improvement of.. I, 319; IV, 2056
  Sturgeon Bay and Lake Michigan Ship Canal, Wis., improvement of harbor of refuge at eastern entrance .... I, 321; IV, 2062
  Sturgeon Bay and Lake Michigan Ship Canal, Wis., operating and care of .... I, 320; IV, 2058
  Tennessee River, operating and care of Muscle Shoals Canal..... I, 284; III, 1828
Canapitsit Channel, Mass., improvement of .... I, 54, 584
Canarsie Bay, N. Y., improvement of....................................... I, 96, 795
Caney Fork River, Tenn., improvement of........................... I, 282; III, 1818
Cape Ann, Mass., improvement of harbor of refuge at Sandy Bay .... I, 39, 536
Cape Charles, Va., removal of wrecks off............................. I, 152; II, 987
Cape Charles City, Va., improvement of harbor and approaches at .... I, 131; II, 904
Cape Fear (North East) River, N. C., improvement of .... I, 163; II, 1040
Cape Fear River, N. C.:
  Improvement of, above Wilmington .... I, 164; II, 1044
  Improvement of, at and below Wilmington .... I, 164; II, 1047
  Removal of wrecks in and near mouth of .... I, 168; II, 1065

Cape Hatteras, N. C., removal of wreck near .... i, 168; ii, 1065
Cape Lookout light-house, removal of wrecks near .... i, 168; ii, 1065
Carabelle, Tallahassee and Georgia Railroad Company, bridge of .... i, 431
Carriages, disappearing .... i, 5, 12
Cascades Canal, Columbia River, Oreg., construction of .... i, 415; iv, 2615
Casemates, mining .... i, 6
Cedar Bayou, Tex., improvement of .... i, 236; iii, 1405
Cedar Keys, Fla., improvement of harbor at .... i, 194; ii, 1244
Cedar River Harbor, Mich., improvement of .... i, 315; iv, 2043
Champlain, Lake:
  Breakwater at Rouse Point, N. Y .... i, 390; iv, 2492
  Improvement of Narrows of .... i, 392; iv, 2499
Charles, Cape, Va., removal of wrecks at .... i, 152; ii, 987
Charles River, Boston Harbor, Mass., improvement of .... i, 44, 552
Charleston Harbor, S. C.:
  Bridge obstructing cove at Sullivans Island, alteration of .... i, 431
  Defense of .... i, 6
  Improvement of .... i, 172; ii, 1101
  Removal of wreck in .... i, 174; ii, 1128
  Sullivans Island, site for fortification .... i, 13
Charlevoix Harbor, Mich., improvement of .... i, 352; iv, 2233
Charlotte Harbor, Fla., improvement of .... i, 191; ii, 1236
Charlotte Harbor, N. Y., improvement of .... i, 383; ii, 2455
Charts, Northern and Northwestern Lakes, correcting, printing, and issuing of .... i, 438, 440; vi, 3315
Chatham, Mass., removal of wreck near .... i, 62, 611
Chatham Bar, Mass., removal of wreck from .... i, 49, 568
Chatham Harbor, Mass.:
  Improvement of .... i, 49, 566
  Removal of wrecks off .... i, 49, 568
Chatham lights, Mass., removal of wreck near .... i, 63, 618
Chatham Roads (Old), Mass., removal of wreck in .... i, 63, 613
Chattahoochee River, Ga. and Ala.:
  Improvement of .... i, 200; ii, 1258
  Improvement of, between West Point and Franklin, Ga .... i, 201; ii, 1261
Cheat River, W. Va., improvement of .... i, 291; iii, 1911
Cheboygan Harbor, Mich., improvement of .... i, 353; iv, 2239
Chefuncte River, La., improvement of .... i, 220; iii, 1349
Chehalis River, Wash.:
  Improvement of .... i, 411; iv, 2604
  Improvement of Grays Harbor and .... i, 410; iv, 2597
Chelsea Creek, Mass., reconstruction of bridge at Boston .... i, 428
Chesapeake Bay, removal of wrecks in .... i, 132, 152; ii, 906, 987
Chester River, Md., improvement of, from Crumpton to Jones Landing. i, 125; ii, 889
Chicago, Ill.:
  Bridge across Chicago River between Jackson and Van Buren streets, construction of .... i, 427
  Bridge east of Wells street, across Chicago River, construction of .... i, 428
  Bridge east of Wells street bridge, across Chicago River, construction of. i, 429
  Bridge of city across Chicago River at Van Buren street, reconstruction of. i, 427
  Improvement of channels in connecting waters of Great Lakes between Duluth, Buffalo, and .... i, 361; iv, 2261
  Improvement of harbor of .... i, 331; iv, 2127
Chicago River, Ill.:
  Bridge across South Branch of, at Van Buren street, reconstruction of .... i, 427
  Bridge across South Branch of, between Jackson and Van Buren streets, construction of .... i, 427
  Bridge east of Wells street bridge, Chicago, construction of .... i, 429
  Bridge east of Wells street, Chicago, construction of .... i, 428
Chicago (South), Ill.:
  Alteration of bridge across Calumet River .... i, 430
  Construction of bridge across Calumet River .... i, 425
Chickahominy River, Va., improvement of .... i, 149; ii, 980
Chickasahay River, Miss., improvement of .... i, 215; ii, 1322
Chief of Engineers, Office of the .... i, 444
Chincoteague Bay:
  Bridge (temporary) across canal connecting Delaware Bay and, construction of .... i, 430
  Improvement of inland waterway from Delaware Bay near Lewes to. i, 123; ii, 884
Chipola River, Fla., improvement of .... i, 197; ii, 1252

Chippewa River, Wis.:
  Improvement of.... I, 266; III, 1718
  Reservoirs at sources of, surveys for.... III, 1736
Chitto, Bogue, La., improvement of.... I, 218; II, 1331
Choctawhatchee River, Fla. and Ala., improvement of.... I, 202; II, 1263
Choptank River, Md., improvement of.... I, 126; II, 891
Christiana River, Del.:
  Improvement of Wilmington Harbor.... I, 118; II, 870
  Removal of wreck in.... I, 132; II, 906
Churchills Ferry, Texas, construction of bridge across San Bernard River.... I, 426
Cincinnati, Ohio, examination and survey for ice harbors at mouths of Crawfish and Mill creeks.... I, 289; III, 1890
Clark River, S. C., improvement of.... I, 170; II, 1079
Clarke County, Wash., construction of bridge across East Fork of Lewis River by.... I, 428
Clarke, David (steamer), removal of wreck of.... I, 182; II, 1209
Clendennin, W. Va., construction of bridge across Elk River.... I, 429
Cleveland Harbor, Ohio, improvement of.... I, 375; IV, 2409
Clinch River, Tenn., improvement of.... I, 277; III, 1801
Clinton Harbor, Conn., improvement of.... I, 68, 640
Clinton River, Mich., improvement of.... I, 359; IV, 2254
Clubfoot and Harlowe Canal, N. C., improvement of waterway via.... I, 159; II, 1030
Clubfoot River, N. C., improvement of waterway via.... I, 159; II, 1030
Cocheco River, N. H., improvement of.... I, 34, 524
Coit, W. W. (steamer), removal of wreck of.... I, 145; II, 971
Colorado River, at Yuma, Ariz., improvement of.... I, 397; IV, 2521
Columbia, Department of the, report of engineer officer.... I, 443; VI, 3452
Columbia, Tex., construction of bridge across Brazos River at.... I, 428
Columbia River, Oreg. and Wash.:
  Construction of Cascades Canal.... I, 415; IV, 2645
  Examination for improvement between Three Mile Rapids and Celilo Falls.... I, 418; IV, 2664
  Gauging.... I, 418; IV, 2664
  Improvement of, between Rock Island Rapids and Priest Rapids.... I, 409; IV, 2593
  Improvement of, between Vancouver and Willamette River.... I, 414; IV, 2643
  Improvement of mouth of.... I, 413; IV, 2631
  Improvement of Snake River and upper part of.... I, 408; IV, 2590
  Improvement of Willamette River and, below Portland.... I, 416; IV, 2654
Common Flats, Old Chatham Roads, Mass., removal of wreck on.... I, 63, 613
Compton Creek, N. J., improvement of.... I, 105, 818
Conecuh River, Ala., improvement of.... I, 204; II, 1275
Congaree River, S. C., improvement of.... I, 171; II, 1092
Conneaut Harbor, Ohio, improvement of.... I, 377; IV, 2423
Connecticut River, Mass. and Conn.:
  Improvement of.... I, 65, 630
  Improvement of, above Hartford.... I, 65, 630
  Improvement of, below Hartford.... I, 66, 632
Contentnia Creek, N. C.:
  Bridge near Grifton, construction of.... I, 426
  Improvement of.... I, 157; II, 1022
Contingencies, examinations, and surveys of rivers and harbors, estimates for. I, 419
Coos Bay and Harbor, Oreg., improvement of.... I, 403; IV, 2561
Coosa River, Ga. and Ala.:
  Improvement of.... I, 206; II, 1285
  Improvement of, between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge.... I, 207; II, 1286
  Improvement of, between Wetumpka, Ala., and East Tennessee, Virginia and Georgia Railroad bridge.... I, 208; II, 1291
  Operating and care of locks and dams on.... I, 208; II, 1297
Coquille River, Oreg.:
  Improvement of, at the entrance.... I, 402; IV, 2553
  Improvement of, between Coquille City and Myrtle Point.... I, 403; IV, 2558
Corney, Bayou, La., improvement of.... I, 242; III, 1468
Corporations, occupancy or injury of public structures by.... I, 20, 431; VI, 3189
Corps of Engineers:
  Number of officers.... I, 3
  Changes during the year.... I, 3
  Distribution of officers.... I, 3, 444
  Laws of Fifty-third Congress, second session, affecting the.... VI, 3455
  Officers detached.... I, 4

Cos Cob Harbor, Conn., improvement of.......... I, 75, 681
Courtableau, Bayou, La., improvement of.......... I, 225; III, 1365
Cow Bayou, Tex., construction of bridge of Orange County across.......... I, 426
Cowlitz River, Wash., improvement of.......... I, 417; IV, 2662
Crawfish Creek, Cincinnati, Ohio, examination and survey for ice harbor at mouth of.......... I, 289; III, 1890
Creighton Bridge Company, bridge of.......... I, 428
Creighton, Pa., construction of bridge across Allegheny River.......... I, 428
Cross-over Light, St. Lawrence River, N. Y., improvement of shoals near.......... I, 389; IV, 2489
Cumberland River, Tenn. and Ky.:
  Construction of locks and dams on.......... I, 278; III, 1804
  Improvement of.......... I, 278; III, 1804
  Improvement of, above Nashville, Tenn.......... I, 279; III, 1807
  Improvement of, below Nashville, Tenn.......... I, 278; III, 1805
Cumberland Sound, Ga., improvement of.......... I, 181; II, 1200
Current River, Ark. and Mo., improvement of.......... I, 254
Currituck Sound, N. C., improvement of waterway through.......... I, 151; II, 983
Curtis Bay, Md., improvement of channel to.......... I, 133; II, 914
Cushings Island, Me., site for fortification.......... I, 13
Cut-off, Apalachicola River, Fla., improvement of.......... I, 197; II, 1252
Cuttyhunk, Mass., removal of wreck near.......... I, 63, 619

D.

Dams and locks. *See* Canals.
D'Arbonne Bayou, La., improvement of.......... I, 242; III, 1468
Darien Harbor, Ga., improvement of.......... I, 177; II, 1166
Davids Island, N. Y., sea wall and embankment at.......... I, 14
Davis Island Dam, Ohio River, operating and care of.......... I, 287; III, 1867
Defenses. *See* Fortifications.
De Guerre Point, Cal., construction of dam in Yuba River at.......... I, 421; VI, 3174
Delaware Bay:
  Bridge (temporary) across canal connecting Chincoteague Bay and, construction of.......... I, 430
  Ice harbor at head of, improvement of.......... I, 112; II, 849
  Inland waterway from Chincoteague Bay, Va., to, near Lewes, improvement of.......... I, 123; II, 884
  Pier at Lewes, Del., construction of.......... I, 113; II, 850
  Wreck, removal of.......... II, 862
Delaware Breakwater, Del., improvement of.......... I, 114; II, 852
Delaware River, N. J. and Pa.:
  At Camden, N. J., improvement of.......... I, 108, 110; II, 827, 836
  At Philadelphia, Pa., improvement of.......... I, 108, 110; II, 827, 836
  Between Philadelphia and Camden, improvement of.......... I, 110; II, 836
  Harbor lines at Philadelphia and Camden, establishment of.......... I, 423; II, 861
  Ice harbor at Marcus Hook, Pa., improvement of.......... I, 112; II, 848
  Improvement of.......... I, 108; II, 827
  Mifflin, Fort, Pa., sale of Government land in vicinity of.......... I, 461
  Wrecks, removal of.......... I, 117, 118; II, 861, 862
De Pere, Wis., construction of bridge across Fox River and canal by city of.. I, 427
Depot, engineer.......... I, 18, 474
Des Moines Rapids Canal and dry dock, Mississippi River, operating and care of.......... I, 263; III, 1684
Des Moines Rapids, Mississippi River, improvement of.......... I, 263; III, 1683
Detroit River, Mich., improvement of.......... I, 367; IV, 2376
Disappearing carriages.......... I, 5, 12
District of Columbia:
  Great Falls, Potomac River, use of water power for electric lighting... VI, 3256
  Public buildings and grounds.......... I, 435; VI, 3265
  Washington aqueduct.......... I, 432; VI, 3193
  Washington monument.......... I, 435; VI, 3267
  Water supply of Washington, D. C., increasing.......... I, 434; VI, 3222
Division engineers.......... I, 20
Divisions, engineer.......... I, 20
Dog River, Ala., construction of bridge across.......... I, 426
Dorchester County, Md., construction of bridge across Cambridge Harbor at Cambridge by.......... I, 429
Dow, Mary E. H. G. (schooner), removal of wreck of.......... I, 152; II, 987
Duck Island Harbor, Conn., improvement of harbor of refuge at.......... I, 67, 638

- Duluth, Minn.:
  - Improvement of channels in connecting waters of Great Lakes between Buffalo, Chicago, and ..... I, 361; IV, 2261
  - Improvement of harbor at ..... I, 309; IV, 2014
- Dunkirk Harbor, N. Y., improvement of ..... I, 379; IV, 2434
- Dunnellon, Fla., construction of bridge across Withlacoochee River ..... I, 429

E.

- Eagle Harbor, Mich., improvement of ..... I, 312; IV, 2028
- East Chester Creek, N. Y., improvement of ..... I, 77, 688
- East Liverpool Bridge Company, bridge of ..... I, 425
- East Liverpool, Ohio, construction of bridge across Ohio River ..... I, 425
- East River, N. Y.:
  - Improvement of ..... I, 87. 751
  - Removal of wrecks off Sunken Meadow ..... I, 95, 785, 786
- Eastern Branch of Potomac River. *See* Anacostia River.
- Edgartown, Marthas Vineyard, Mass., improvement of inner harbor at ..... I, 51, 576
- Edisto River, S. C., improvement of ..... I, 173; II, 1119
- Elizabeth River, N. J.:
  - Improvement of ..... I, 100, 804
  - Removal of wrecks in ..... I, 108, 823
- Elizabeth River, Va., bridge across Western Branch of, between West Norfolk and Port Norfolk, construction of ..... I, 429
- Elk River, Md., improvement of ..... I, 124; II, 888
- Elk River, W. Va.:
  - Bridge at Clendennin, construction of ..... I, 429
  - Improvement of ..... I, 299; III, 1963
- Embankments ..... I, 14
- Emplacements for guns and mortars ..... I, 5, 11
- *Enchantress* (schooner), removal of wreck of ..... I, 168; II, 1065
- Engineer depot ..... I, 18, 474
- Engineer divisions ..... I, 20
- Engineer School, United States ..... I, 17, 468
- Engineers, battalion of ..... I, 17, 469
- Engineers, Corps of. *See* Corps of Engineers.
- Engineers, division ..... I, 20
- Engineers, Office of the Chief of ..... I, 444
- Engineers, The Board of:
  - Members ..... I, 15
  - Members, additional duties of ..... I, 16
  - Personal examinations ..... I, 16
  - Reports, summary of ..... I, 15
- *Enterprise* (canal boat), removal of wreck of ..... I, 118; II, 862
- Erie Harbor, Pa.:
  - Improvement of ..... I, 378; IV, 2427
  - Preservation of Presque Isle Peninsula ..... I, 379; IV, 2433
- Erie, Lake:
  - *See also* Northern and Northwestern Lakes.
  - Removal of wreck off Ashtabula Harbor, Ohio ..... I, 378; IV, 2426
  - Water levels ..... I, 441; VI. 3430, 3431
- Escambia River, Fla., improvement of ..... I, 204; II, 1275
- Essex River, Mass., improvement of ..... I, 39, 536
- Estimates:
  - California Débris Commission ..... VI, 3175
  - Engineer depot ..... I, 19
  - Examinations, surveys, and contingencies of rivers and harbors ..... I, 419
  - Fortifications ..... I, 5, 15
  - Great Falls, Potomac River, erection of fishways at ..... I, 435
  - Maps, publication of ..... I, 443
  - Mississippi River Commission ..... I, 421
  - Missouri River Commission ..... I, 421
  - New York Harbor, supervision of ..... I, 420
  - Northern and Northwestern Lakes ..... I, 441
  - Public buildings and grounds, and Washington monument, District of Columbia ..... I, 437
  - Rivers and harbors ..... I, 19
  - Surveys and reconnaissances and publication of maps ..... I, 443
  - Washington aqueduct ..... I, 434
  - Washington, D. C., increasing water supply of ..... I, 436
  - Yellowstone National Park, roads and bridges in ..... I, 442

Everett Harbor, Wash.:
  Establishment of harbor lines .... I, 424; IV, 2627
  Improvement of .... IV, 2623
Examinations, surveys, and contingencies of rivers and harbors, estimates for. I, 413
Explorations, reconnaissances, and surveys in military departments.. I, 449; VI, 3451

F.

Fairlee Creek, Md., improvement of .... I, 125; II, 888
Fairport Harbor, Ohio, improvement of.......... I, 376; IV, 2414
Falia, Bogue, Fla., improvement of .... I, 220; III, 1349
Falls of Ohio River:
  Improvement of, Louisville, Ky .... I, 293; III, 1929
  Improvement of Indiana Chute .... I, 295; III, 1933
Farnsworth, G. M. (schooner), removal of wreck of .... I, 63, 613
Faulkners Island, Long Island Sound, removal of wreck near .... I, 82, 712
Feather River, Cal.:
  Improvement of.......... I, 399; IV, 2533
  Improvement of, and tributaries.......... I, 421; VI, 3174
Fernandina, Fla., improvement of inside route between Savannah, Ga., and .... I, 182; II, 1206
Fishing Creek, N. C., improvement of.......... I, 156; II, 1018
Fishways at Great Falls of Potomac River, erection of .... I, 435; VI, 3224
Five Mile River Harbor, Conn., improvement of .... I, 74, 674
Flint River, Ga., improvement of.......... I, 198; II, 1255
Flood Rock (U. S. dredge), removal of wreck of .... I, 95, 785
Flushing Bay, N. Y., improvement of .... I, 80, 703
Forked Deer River, Tenn., improvement of.......... I, 250; III, 1519
Fort Point Channel, Mass. *See* Boston Harbor.
Fortifications:
  Allotments.......... I, 6, 12
  Appropriations .... I, 5
  Board on, or other defenses.......... I, 4
  Estimates.......... I, 5, 15
  Preservation and repair of.......... I, 12
  Projects .... I, 5
  Sites for, acquisition of .... I, 13
Fourche Le Fevre River, Ark., improvement of.......... I, 252; III, 1544
Fowl River, Ala., construction of bridge across.......... I, 426
Fox River, Wis.:
  Bridge at De Pere, construction of .... I, 427
  Bridge at Kaukauna across river and canal, construction of.......... I, 427
  Improvement of.......... I, 329; IV, 2103
  Operating and care of locks and dams on.......... I, 330; IV, 2111
Frankfort Harbor, Mich., improvement of .... I, 351; IV, 2230
Franklin (schooner), removal of wreck of.......... I, 63, 616
French Broad River, Tenn., improvement of.......... I, 276; III, 1797

G.

Galena River, Ill., operating and care of.......... I, 263; III, 1691
Galleries, cable .... I, 6
Galveston Bay, Tex.:
  Improvement of channel in West Galveston Bay .... I, 235; III, 1399
  Improvement of ship channel in.......... I, 234; III, 1396
Galveston Harbor, Tex., improvement of entrance to.......... I, 233; III, 1389
Gasconade River, Mo., improvement of .... I, 259; III, 1617
Gauley River, W. Va., improvement of .... I, 300; III, 1964
Gedney Channel, New York Harbor, N. Y., removal of wreck in .... I, 95, 785
General Grant (canal boat), removal of wreck of.......... I, 117, II, 861
Genesee River, N. Y. *See* Charlotte Harbor.
George, Lake, Fla., improvement of Volusia Bar at head of .... I, 186; II, 1220
Georgetown Harbor, S. C., improvement of .... I, 166; II, 1057
Georgia, improvement of inside waterway along coast of.......... I, 182; II, 1206
Gila River, Ariz., improvement of, at Yuma.......... I, 397; IV, 2521
Gills Landing, Wis., construction of bridge across Wolf River.......... I, 427
Glen Cove Harbor, N. Y., improvement of.......... I, 79, 700
Gloucester Harbor, Mass., improvement of.......... I, 40, 539
Gonsoulin, Adrien, bridge of .... I, 429
Goodyear, C. P., improvement of outer bar at Brunswick, Ga., by... I, 180; II, 1193

Goshen Creek, N. J., improvement of .... I, 117; II, 859
Governors Island, N. Y., sea wall and embankment at .... I, 14
Gowanus Bay, N. Y., improvement of .... I, 91, 764
Gowanus Creek Channel, New York Harbor, N. Y., improvement of .... I, 91, 764
Grand Haven Harbor, Mich., improvement of .... I, 343; IV, 2208
Grand Lake, La., improvement of .... I, 227; III, 1372
Grand Marais, Mich., improvement of harbor of refuge at .... I, 314; IV, 2037
Grand Marais, Minn., improvement of harbor at .... I, 308; IV, 2009
Grand River, La.:
  Improvement of .... I, 224; III, 1361
  Removal of wreck in .... I, 232; III, 1383
Grand River, Ohio. *See* Fairport Harbor.
Grant, General (canal boat), removal of wreck of .... I, 117; II, 861
Grays Harbor, Wash., improvement of .... I, 410; IV, 2597
Great Chazy River, N. Y., improvement of .... I, 390; IV, 2493
Great Falls, Potomac River:
  Erection of fishways at .... I, 435; VI, 3224
  Use of water power of, for electric lighting .... VI, 3256
Great Kanawha River, W. Va.:
  Improvement of .... I, 297; III, 1951
  Operating and care of locks and dams on .... I, 299; III, 1962
Great Lakes:
  See also Northern and Northwestern Lakes.
  Improvement of channels in connecting waters of, between Chicago, Duluth, and Buffalo .... I, 361; IV, 2261
  Raft-towing on, and connecting waters .... I, 368; IV, 2378
Great Pedee River, S. C., improvement of .... I, 170; II, 1076
Great Sodus Bay, N. Y., improvement of harbor at .... I, 385; IV, 2464
Green Bay, Wis., water levels .... I, 441; VI, 3430
Green Bay Harbor, Wis., improvement of .... I, 318; IV, 2053
Green, George G. (schooner), removal of wreck of .... I, 168; II, 1065
Green Jacket Shoal, Providence River, R. I., removal of .... I, 57, 592
Green River, Ky.:
  Improvement of, above mouth of Big Barren River (Lock No. 5) .... I, 302; III, 1971
  Operating and care of locks [illegible]ns on .... I, 302; III, 1972
  Reconstruction of Lock No. [illegible]msey .... I, 302; III, 1968
Greenport Harbor, N. Y.:
  Establishment of harbor lines .... I, 422, 716
  Improvement of .... I, 78, 692
Grifton, N. C., construction of bridge across Contentnia Creek near .... I, 426
Grossepoint Channel, Mich., improvement of .... I, 366; IV, 2376
Grovers Cliff, Mass., site for fortification .... I, 13
Gun batteries .... I, 5, 11, 12
Gun emplacements .... I, 5
Gun platforms .... I, 12
Guyandotte River, W. Va., improvement of .... I, 306; III, 2004

H.

Hampton Roads, Va., defense of .... I, 6, 10
Handkerchief light-ship, Mass., removal of wreck near .... I, 62, 612
Handkerchief Shoal, Mass., removal of wreck in slough of .... I, 62, 608
Hankinsons Ferry, Miss., construction of bridge across Big Black River .... I, 430
Harbor lines, establishment of .... I, 20, 422
  Alameda Harbor, Cal .... I, 424; IV, 2505
  Delaware River, Pa. and N. J .... I, 423; II, 864
  Everett Harbor, Wash .... I, 424; IV, 2627
  Greenport Harbor, N. Y .... I, 422, 716
  Harlem River, N. Y .... I, 422, 786
  Missouri River, Kans. and Mo .... I, 423; VI, 3159
  Napa River, Cal .... I, 424; IV, 2522
  Niagara River, N. Y .... I, 424; IV, 2453
  Oakland Harbor, Cal .... I, 424; IV, 2505, 2506
  Oconto Harbor, Wis .... I, 424; IV, 2124
  Ohio River, Ohio .... I, 423; III, 1894
  Patchogue River, N. Y .... I, 422, 719
  St. Joseph Harbor, Mich .... I, 424; IV, 2258
  San Francisco Bay, Cal .... I, 424; IV, 2505, 2506
  Shrewsbury River, N. J .... I, 423, 823
  Superior Bay, Wis .... I, 423; IV, 2089
  Westchester Creek, N. Y .... I, 423, 790

Harbors and rivers. *See* Rivers and harbors.
Harlem River, N. Y.:
  Improvement of.......... I, 86, 741
  Modification of harbor lines.......... I, 422, 786
Harlowe and Clubfoot Canal. N. C , improvement of waterway via... I, 159; II, 1030
Harlowe River, N. C., improvement of waterway via.......... I, 159; II, 1030
Harraseeket River, Me., improvement of.......... I, 29, 512
Hartford, Conn.:
  Improvement of Connecticut River above.......... I, 65, 630
  Improvement of Connecticut River below.......... I, 66, 632
Hatteras, Cape, N. C., removal of wreck near.......... I, 168; II, 1065
Haverhill, Mass., alteration of city bridge obstructing Merrimac River between Bradford and.......... I, 430
Havre de Grace, Md., improvement of Susquehanna River in vicinity of I, 124; II, 886
Hay Lake Channel, St. Marys River, Mich., improvement of.......... I, 364; IV, 2367
Hell Gate, East River, N. Y., improvement of.......... I, 87, 751
Hempstead, N. Y., construction of bridge across Nortons Creek by town of.... I, 427
Henlopen City, Del., construction of temporary bridge near, across canal connecting Chincoteague and Delaware bays.......... I, 430
Herr Island, Pa., construction of dam in Allegheny River at.......... I, 292; III, 1918
Hillsborough River, Fla., construction of bridge at Tampa.......... I, 426
Hilton, J. D. (canal boat), removal of wreck of.......... I, 132; II, 906
Hingham Harbor, Mass., improvement of.......... I, 46, 557
Hiwassee River, Tenn., improvement of.......... I, 275; III, 1795
Holland (Black Lake) Harbor, Mich., improvement of.......... I, 343; IV, 2206
Holston River, Tenn., construction of bridge at Boyds Ferry, near Knoxville.. I, 427
Hopkins, L. F. (schooner), removal of wreck of.......... I, 63, 620
Horseshoe, the, Chesapeake Bay, removal of wreck on.......... I, 152; II, 987
Housatonic River, Conn., improvement of.......... I, 71, 654
Houston, Tex., construction of bridge across Buffalo Bayou by city of.......... I, 428
Hudson (barge), removal of wreck of.......... II, 907
Hudson River, N. Y., improvement of.......... I, 83, 723
Humboldt Harbor and Bay, Cal., improvement of.......... I, 401; IV, 2540
Huntington Harbor, N. Y., improvement of.......... I, 79, 698
Huron Harbor, Ohio, improvement of.......... I, 372; IV, 2400
Huron, Lake:
  See also Northern and Northwestern Lakes.
  Harbor of refuge at Sand Beach, Mich.......... I, 356; IV, 2247
  Water levels.......... I, 441; VI, 3319, 3430
Hyannis, Mass., improvement of harbor of refuge at.......... I, 50, 571
Hyannis Harbor, Mass., removal of wrecks in.......... I, 63, 614, 615, 616
Hydraulic mining in California.......... I, 421; VI, 3196

I.

Illinois and Mississippi Canal, Ill., construction of.......... I, 336; IV, 2162
Illinois River, Ill.:
  Improvement of.......... I, 334; IV, 2150
  Operating and care of La Grange and Kampsville locks and dams. I, 335; IV, 2159
Indian River, Fla., improvement of.......... I, 188; II, 1225
Indiana Chute, Falls of Ohio River, improvement of.......... I, 295; III, 1933
Individuals, occupancy or injury of public structures by.......... I, 20, 431; VI, 3189
Injury to structures built by the United States.......... I, 20, 431; VI, 3189
Inland waterways. *See* Waterways.
Inside routes, waterways, etc. *See* Waterways.
Ipswich River, Mass., improvement of.......... I, 38, 534

J.

Jamaica Bay, N. Y., improvement of,.......... I, 93, 779
James River, Va., improvement of.......... I, 133; II, 915
Jeffreys Point Channel, Mass. *See* Boston Harbor.
Jekyl Creek, Ga., improvement of.......... I, 181; II, 1197
Judith, Point, R. I., improvement of harbor of refuge at.......... I, 58, 596
Julia (vessel), removal of wreck of.......... I, 62, 610
Juliette (vessel), removal of wreck of.......... I, 62, 610

K.

Kampsville lock and dam, Illinois River, Ill., operating and care of.. I, 335; IV, 2159
Kanawha County, W. Va., construction of bridge across Elk River at Clendennin by.......... I, 429

Kansas City, Kans., establishment of harbor lines.................... I, 423; VI, 3159
Kansas City, Mo., establishment of harbor lines.................... I, 423; VI, 3159
Kaskaskia River, Ill., improvement of.................... I, 260; III, 1624
Kaukauna, Wis.:
  Construction of bridge across Fox River and canal by city of............ I, 427
  Construction of bridge across lock of canal at Little Chute by city of.... I, 429
Kelsey, John P. (schooner), removal of wreck of.................... I, 62, 612
Kennebec River, Me., improvement of .... I, 28, 508
Kenosha Harbor, Wis., improvement of.................... I, 327; IV, 2097
Kensington Rapid Transit Bridge Company, bridge of.................... I, 428
Kent Island, Chesapeake Bay, removal of wreck off.................... I, 132; II, 906
Kent (schooner), removal of wreck of.................... I, 117; II, 861
Kentucky River, Ky.:
  Improvement of.................... I, 303; III, 1980
  Operating and care of locks and dams on.................... I, 304; III, 1983
Kewaunee Harbor, Wis., improvement of.................... I, 322; IV, 2066
Keweenaw Bay, Mich., waterway across Keweenaw Point from Lake Superior to:
  Improvement of.................... I, 312; IV, 2029
  Operating and care of .... I, 313; IV, 2029
Keweenaw Point, Mich., waterway across:
  Improvement of.................... I, 312; IV, 2029
  Operating and care of.................... I, 313; IV, 2029
Key West Harbor, Fla., improvement of northwest entrance......... I, 189; II, 1230
Keyport Harbor, N. J., improvement of .... I, 104, 815
Kingston Harbor, Mass., improvement of .... I, 47, 562
Klaskanine River, Oreg., improvement of.................... I, 418; IV, 2663
Knox County, Tenn., construction of bridge across Holston River by.......... I, 427
Knoxville, Tenn., construction of bridge across Holston River near........... I, 427

L.

La Center, Wash., construction of bridge across East Fork of Lewis River.... I, 428
Lafourche, Bayou, La., improvement of.................... I, 223; III, 1356
La Grange lock and dam, Illinois River, Ill., operating and care of... I, 335; IV, 2159
Lake Shore and Michigan Southern Railroad Company, bridge of............. I, 425
Lake Street Elevated Railroad Company, bridge of.................... I, 429
Lakes, Great. *See* Great Lakes *and* Northern and Northwestern Lakes.
Lakes, Northern and Northwestern. *See* Northern and Northwestern Lakes.
Larchmont Harbor, N. Y., improvement of.................... I, 77, 686
La Trappe River, Md., improvement of .... I, 126; II, 892
Laws of Fifty-third Congress, second session, affecting Corps of Engineers. VI, 3455
Lea, Charles (tugboat), removal of wreck of.................... I, 132; II, 906
Leaf River, Miss., improvement of.................... I, 216; II, 1323
Leon (tug), removal of wreck of.................... I, 182; II, 1209
Levisa Fork of Big Sandy River, Ky., improvement of.............. I, 305; III, 2001
Lewes, Del.:
  Construction of pier at .... I, 113; II, 859
  Improvement of inland waterway from Chincoteague Bay, Va., to Delaware Bay near .... I, 123; II, 884
Lewis River, Wash., construction of bridge at La Center, across East Fork of.. I, 428
Licking River, Ky., improvement of, between Farmers and West Liberty .... I, 304; III, 1992
Little Chute, Wis., construction of bridge across lock of canal at.............. I, 429
Little Harbor, N. H., improvement of harbor of refuge at.................... I, 35, 527
Little Kanawha River, W. Va.:
  Improvement of .... I, 307; III, 2006
  Operating and care of lock and dam on.................... I, 307; III, 2007
Little Pedee River, S. C., improvement of.................... I, 169; II, 1074
Little Pigeon River, Tenn., improvement of .... I, 277; III, 1800
Little Rock, Ark., construction of bridge across Arkansas River............... I, 425
Little Rock Bridge and Terminal Railway Company, bridge of................ I, 425
Little Sodus Bay, N. Y., improvement of harbor at.................... I, 386; IV, 2470
Liverpool (East), Ohio, construction of bridge across Ohio River............. I, 425
Livingston Point, Ky., preservation of .... I, 275; III, 1792
Locks and dams. *See* Canals.
Lockwoods Folly River, N. C., improvement of.................... I, 166; II, 1056
Logstown, Pa., removal of wrecks in Ohio River at .... I, 289; III, 1889

Long Island, channel between Nixs Mate and. *See* Boston Harbor, Mass.
Long Island Sound, removal of wrecks in .... I, 82, 712, 714
Long Sand Shoal, Long Island Sound, removal of wreck near.............. I, 82, 714
Lookout, Cape, light-house, removal of wrecks near.................. I, 168; II, 1065
Loreauville, La., construction of bridge across Bayou Teche near.............. I, 429
Louisa, Ky., construction of lock and dam in Big Sandy River near.. I, 305; III, 1992
Louisville and Portland Canal, Ohio River, operating and care of.... I, 295; III, 1935
Louisville, Ky., Falls of Ohio River at:
  Improvement of.. I, 293; III, 1929
  Improvement of Indiana Chute...................................... I, 295; III, 1933
  Operating and care of Louisville and Portland Canal .... I, 295; III, 1935
Lower Chipola River, Fla., improvement of........................... I, 197; II, 1252
Lower Machodoc Creek, Va., improvement of .... I, 141; II, 950
Lubec Channel, Me., improvement of .... I, 21, 491
Ludington Harbor, Mich., improvement of.............................. I, 348; IV, 2220
Lula (schooner), removal of wreck of.................................... I, 152; II, 987
Lumber River, N. C. and S. C., improvement of .... I, 169; II, 1071
Lynn Harbor, Mass., improvement of .... I, 42, 545

M.

McClary, Fort, reservation, Me., site for fortification .... I, 13
McHenry, Fort, Md., sea wall at.. I, 14
McIntyre, Fla., alteration of bridge obstructing Ocklochonee River........... I, 431
Machodoc (Lower) Creek, Va., improvement of........................ I, 141; II, 950
Mackeys Creek, N. C., improvement of .... I, 155; II, 995
Macon, Bayou, La., improvement of....................................... I, 244; III, 1479
Malden River, Mass., improvement of.. I, 43, 547
Manasquan River, N. J., improvement of.. I, 107, 822
Manatee River, Fla., improvement of...................................... I, 192; II, 1238
Manchac, Bayou, La., improvement of..................................... I, 222; III, 1354
Manchester Harbor, Mass., improvement of .... I, 41, 542
Manistee, Mich., construction of bridge across Manistee River by city of ..... I, 427
Manistee Harbor, Mich., improvement of................................. I, 348; IV, 2223
Manistee River, Mich., construction of bridge at Manistee .... I, 427
Manistique, Mich., improvement of harbor at .... I, 315; IV, 2012
Manitowoc Harbor, Wis., improvement of .... I, 323; IV, 2072
Manokin River, Md., improvement of .... I, 130; II, 901
Maps, military and other .... I, 443
Marcus Hook, Pa., improvement of ice harbor at .... I, 112; II, 848
Marquette, Mich., improvement of harbor at .... I, 313; IV, 2035
Marthas Vineyard, Mass.:
  Improvement of inner harbor at Edgartown .... I, 51, 576
  Removal of wreck near .... I, 63, 619
Martins Ferry, Ohio, establishment of harbor lines in Ohio River.... I, 423; III, 1894
Maryland (steamer), removal of wreck of .... I, 118; II, 862
Mattaponi River, Va., improvement of .... I, 144; II, 966
Mattawan Creek, N. J., improvement of.. I, 104, 816
Maumee Bay, Ohio. *See* Toledo Harbor.
Maumee River, Ohio. *See* Toledo Harbor.
Maurice River Cove, Delaware Bay, removal of wreck in........................ II, 862
Menominee Harbor, Mich. and Wis., improvement of................. I, 316; IV, 2045
Menominee River, Mich. and Wis., improvement of................... I, 316; IV, 2047
Mermentau River and tributaries, La., improvement of .... I, 227; III, 1372
Merrimac River, Mass.:
  Bridge between Haverhill and Bradford obstructing, alteration of......... I, 430
  Improvement of... I, 37, 532
Messer, Laura E. (schooner), removal of wreck of .... I, 63, 617
Metropolitan West Side Elevated Railroad Company, bridge of .... I, 427
Mianus River, Conn., improvement of .... I, 75, 681
Michigan City Harbor, Ind., improvement of........................... I, 337; IV, 2188
Michigan, Lake:
  See also Northern and Northwestern lakes.
  Dredging harbors on east coast of .... IV, 2237
  Water levels .... I, 441; VI, 3430, 3435
Middle Ground (Outer), Chesapeake Bay, removal of wreck on........ I, 152; II, 987
Mifflin, Fort, Pa., sale of Government land on Delaware River in vicinity of. I, 461
Milford Harbor, Conn., improvement of .... I, 70, 650
Military and other maps.. I, 443

Military departments, surveys, reconnaissances, and explorations in .. I, 443; VI, 3451
Mill Creek, Cincinnati, Ohio, examination and survey for ice harbor at mouth of .... I, 289; III, 1890
Milton (barge), removal of wreck of .... I, 95, 786
Milwaukee, Wis.:
  Improvement of harbor at .... I, 326; IV, 2091
  Improvement of harbor of refuge at Milwaukee Bay .... I, 325; IV, 2081
Milwaukee Bay, Wis., improvement of harbor of refuge at .... I, 325; IV, 2081
Mines, submarine .... I, 6
Mingo Creek, S. C., improvement of .... I, 170; II, 1081
Mining casemates .... I, 6
Mining, hydraulic, in California .... I, 421; VI, 3169
Minnesota River, Minn., improvement of .... I, 267; III, 1725
Mispillion River, Del.:
  Improvement of .... I, 122; II, 881
  Removal of wreck in .... I, 132; II, 906
Mississippi River:
  Bridge at Red Wing, Minn., construction of .... I, 425
  Bridge at South St. Paul, Minn., construction of .... I, 425
  Des Moines Rapids, improvement of .... I, 263; III, 1683
  Des Moines Rapids Canal and dry dock, operating and care of .. I, 263; III, 1684
  Falls of St. Anthony, Minn., improvement above .... I, 264; III, 1693
  Gauging, and tributaries .... I, 250; III, 1523
  Gauging, at St. Paul, Minn .... I, 269; III, 1732
  Minneapolis to Missouri River, improvement from .... I, 262; III, 1639
  Minneapolis to St. Paul, construction of locks and dams from .... III, 1640, 1681
  Ohio River, improvement, surveys, etc., below .... I, 420; V, 2697
  Ohio and Missouri rivers, improvement between .... I, 256; III, 1577
  Plaquemine, Bayou, La., prevention of caving at mouth of .... I, 232; III, 1385
  Quincy Bay, Ill., improvement of .... I, 262; III, 1639
  Reservoirs at headwaters of .... I, 264; III, 1696
  Reservoirs at sources of, surveys for .... III, 1736
  St. Louis, Mo., improvement at .... I, 258; III, 1615
  Snag boats and dredge boats on upper river, operating .... I, 261; III, 1627
  Snags and wrecks in lower river, removing .... I, 256; III, 1567
  South Pass, inspection of improvement of .... I, 20, 219; III, 1333
  Walnut Bend, Ark., examination for prevention of cut into St. Francis River .... I, 225; III, 1560
Mississippi River Commission .... I, 420; V, 2697
Mississippi Sound, removal of wreck in .... I, 232; III, 1384
Missouri, Department of the, report of engineer officer .... I, 443; VI, 3451
Missouri River:
  Bridge at Yankton, S. Dak., construction of .... I, 425
  Establishment of harbor lines at Kansas City .... I, 423; VI, 3159
  Examination of, between Three Forks and Canyon Ferry, Mont., to determine availability of water power .... I, 272; III, 1775
  Improvement of, above Sioux City, Iowa .... I, 270; III, 1739
  Improvement of, etc., below Sioux City, Iowa .... I, 421; VI, 3075
  Removing snags above Sioux City, Iowa .... I, 271; III, 1772
Missouri River Commission .... I, 421; VI, 3075
Mitchell, Katie (schooner), removal of wreck of .... I, 63, 616
Mobile, Ala., alteration of bridge across Three Mile Creek, near .... I, 430
Mobile and Birmingham Railway Company, bridge of .... I, 430
Mobile and Dauphin Island Railroad and Harbor Company, bridges of .... I, 426
Mobile Harbor, Ala., improvement of .... I, 210; II, 1301
Mobile River, Ala., removal of wreck in .... I, 219; II, 1332
Mokelumne River, Cal., improvement of .... I, 399; IV, 2531
Monomoy Beach, Mass., removal of wreck near .... I, 63, 618
Monomoy life-saving station, Mass., removal of wreck near .... I, 62, 607
Monomoy Point, Mass., removal of wrecks at and near .... I, 62, 63, 606, 608
Monomoy Point light-house, Mass., removal of wrecks near .... I, 63, 616, 617
Monongahela River, W. Va. and Pa.:
  Bridge at Pittsburg, Pa., construction of .... I, 426
  Construction of locks and dams on .... I, 290; III, 1903
  Improvement of .... I, 290; III, 1903
  Operating and care of locks and dams Nos. 8 and 9 .... I, 291; III, 1908
  Purchase of Lock and Dam No. 6 .... I, 291; III, 1911
  Purchase of Lock and Dam No. 7 .... I, 291; III, 1911
Monroe, Fort, Va., water supply at .... I, 14
Monroe Harbor, Mich .... I, 368; IV, 2383

- *Monroe, Loring* (canal boat), removal of wreck of .... I, 132; II, 907
- Montgomery, Ala., construction of bridge across Alabama River near .... I, 425
- Montgomery Bridge Company, bridge of .... I, 425
- *Moon, W. H.* (dredge), removal of wreck of .... I, 232; III, 1383
- Moosabec Bar, Me., improvement of .... I, 21, 492
- Morristown, N. Y., construction of bridge across St. Lawrence River .... I, 425
- Mortar batteries .... I, 5, 11, 12
- Mortar platforms .... I, 12
- Mount Calvert, Md., construction of bridge across Patuxent River .... I, 428
- Mount Desert, Me., construction of breakwater from Porcupine Island to ... I, 23, 496
- Mount Pleasant and Seaview Railroad Company, bridge of .... I, 431
- Mount Pleasant shore, Charleston Harbor, S. C., improvement of ..... I, 172; II, 1101
- *Mount Vernon* (schooner), removal of wreck of, in Maurice River Cove, Delaware Bay .... II, 862
- *Mount Vernon* (schooner), removal of wreck of, in Root River, Wis .. I, 330; IV, 2124
- Murderkill River, Del., improvement of .... I, 121; II, 879
- Muscle Shoals Canal, Tennessee River, Ala., operating and care of .... I, 284; III, 1828
- Muskegon Harbor, Mich., improvement of .... I, 345; IV, 2211
- Muskingum River, Ohio:
  - Construction of ice harbor at mouth of .... I, 288; III, 1874
  - Improvement of .... I, 288; III, 1875
  - Operating and care of locks and dams on .... I, 289; III, 1876
- Mystic River, Conn., improvement of .... I, 64, 622
- Mystic River, Mass., improvement of .... I, 43, 547

N.

- *N. and W. No. 4* (barge), removal of wreck of .... I, 62, 612
- Nansemond River, Va., improvement of .... I, 148; II, 978
- Nantasket Beach Channel, Mass. *See* Boston Harbor.
- Nantucket, Mass., improvement of harbor of refuge at .... I, 50, 573
- Nantucket Sound, Mass., removal of wrecks in and near .... I, 62, 63, 604, 612, 620
- Napa, Cal., establishment of harbor lines .... I, 424; IV, 2522
- Napa River, Cal.:
  - Establishment of harbor lines at Napa .... I, 424; IV, 2522
  - Improvement of .... I, 393; IV, 2507
- Narragansett Bay, R. I:
  - Defense of .... I, 6, 7
  - Improvement of .... I, 56, 589
- Narraguagus River, Me., improvement of .... I, 22, 494
- Narrows of Lake Champlain, N. Y. and Vt., improvement of .... I, 392; IV, 2499
- Natalbany River, La., improvement of .... I, 221; III, 1352
- Nautilus Shoal, Chesapeake Bay, removal of wreck on .... I, 152; II, 987
- Navigable waters, construction of bridges across .... I, 20, 424
- Navigation, bridges obstructing, action upon .... I, 20, 430
- Neches River, Tex., improvement of .... I, 232; III, 1381
- Nehalem Bay, Oreg., improvement of entrance to .... I, 407; IV, 2588
- Neuse River, N. C.:
  - Improvement of .... I, 159; II, 1027
  - Improvement of waterway between Beaufort Harbor and .... I, 159; II, 1030
- New Bedford Harbor, Mass., improvement of .... I, 53, 582
- New Castle, Del., improvement of ice harbor at .... I, 119; II, 873
- New Haven Harbor, Conn.:
  - Construction of breakwaters in .... I, 69, 646
  - Improvement of .... I, 68, 642
  - Removal of wreck in .... I, 82, 712
- New Jersey, channel between Staten Island and, improvement of .... I, 98, 799
- New River, N. C.:
  - Improvement of .... I, 162; II, 1037
  - Improvement of waterway between Beaufort Harbor and .... I, 161; II, 1034
  - Improvement of waterway between Swansboro and .... I, 161; II, 1037
- New River, Va. and W. Va., improvement of .... I, 301; III, 1965
- New York Central and Hudson River Railroad Company, bridge of .... I, 430
- New York Harbor, N. Y.:
  - Arthur Kill, improvement of .... I, 97, 798
  - Bay Ridge Channel, improvement of .... I, 91, 764
  - Bedloes Island, sea wall at .... I, 14
  - Buttermilk Channel, improvement of .... I, 90, 761
  - Channel between Staten Island and New Jersey, improvement of .... I, 98, 799
  - Davids Island, sea wall and embankment at .... I, 14

New York Harbor, N. Y.—Continued.
  Defense of.. I. 5, 6, 7, 447, 449
  East River and Hell Gate, improvement of.................... I, 87, 751
  Governors Island, sea wall and embankment at................ I, 14
  Gowanus Bay, improvement of................................. I, 91, 764
  Gowanus Creek Channel, improvement of....................... I, 91, 764
  Harbor lines in Harlem River, modification of............... I, 422, 786
  Harlem River, improvement of................................ I, 86, 741
  Harlem River, modification of harbor lines in............... I, 422, 786
  Improvement of.. I, 92, 770
  Red Hook Channel, improvement of............................ I, 91, 764
  Sea walls and embankments................................... I, 14
  Supervision of.. I, 420; IV, 2681
  Wrecks, removal of.. I, 95, 785, 786
Newbern, N. C.:
  Bridge obstructing Trent River, alteration of............... I, 431
  Improvement of waterway between Beaufort Harbor and......... I, 159; II, 1030
Newburyport Harbor, Mass., improvement of..................... I, 36, 529
Newport Harbor, R. I., improvement of......................... I, 57, 593
Newport River, N. C., improvement of waterway via............. I, 159; II, 1030
Newtown Creek, N. Y., improvement of.......................... I, 89, 757
Niagara Falls, N. Y., improvement of Niagara River to......... I, 381; IV, 2447
Niagara River, N. Y.:
  Establishment of harbor lines at Squaw Island............... I, 424; IV, 2452
  Improvement of, from Tonawanda to Port Day (Niagara Falls).. I, 381; IV, 2447
  Improvement of Tonawanda Harbor and......................... I, 381; IV, 2444
Nixs Mate, channel between Long Island and. *See* Boston Harbor, Mass.
Nomini Creek, Va., improvement of............................. I, 140; II, 948
Nooksack River, Wash., improvement of (Puget Sound and tributaries). I, 412; IV, 2619
Norfolk Harbor, Va.:
  Improvement of, and approaches.............................. I, 146; II, 973
  Improvement of approach to, between Lambert Point and Fort Norfolk... I, 147; II, 977
  Improvement of waterway between Albemarle Sound and......... I, 151; II, 983
Norfolk, Va., improvement of approach to U. S. navy-yard at... I, 147; II, 977
Norfolk (West), Va., construction of bridge across Western Branch of Elizabeth River... I, 429
North East (Cape Fear) River, N. C., improvement of........... I, 163; II, 1040
North Landing River, Va. and N. C., improvement of............ I, 152; II, 986
Northern and Northwestern Lakes:
  Charts, correcting, printing, and issuing of................ I, 438, 440; VI, 3315
  Estimates... I, 441
  Improvement of channels in connecting waters of............. I, 361; IV, 2261
  Raft towing on, and connecting waters....................... I, 368; IV, 2378
  Surveys... I, 437; VI, 3315
  Water levels.. I, 441; VI, 3319, 3430
Northwestern Elevated Railroad Company, bridge of............. I, 428
Nortons Creek, N. Y., construction of bridge at Hempstead..... I, 427
Noxubee River, Miss., improvement of.......................... I, 214; II, 1318

O.

Oak Orchard Harbor, N. Y., improvement of..................... I, 383; IV, 2451
Oakland Harbor, Cal.:
  Establishment of harbor lines............................... I, 424; IV, 2505, 2506
  Improvement of.. I, 392; IV, 2501
Obion River, Tenn., improvement of............................ I, 273; III, 1785
Obstructions to navigation, action upon bridges constituting.. I, 20, 430
Occoquan Creek, Va., improvement of........................... I, 138; II, 941
Occupancy of structures built by the United States............ I, 20, 431; VI, 3189
Ocean Traveller (schooner), removal of wreck of............. I, 62, 606
Ocklawaha River, Fla., improvement of......................... I, 187; II, 1221
Ocklochonee River, Fla., alteration of bridge obstructing, at McIntyre... I, 431
Ocmulgee River, Ga., improvement of........................... I, 179; II, 1181
Oconee River, Ga., improvement of............................. I, 179; II, 1175
Oconto Harbor, Wis.:
  Modification of harbor lines................................ I, 424; IV, 2124
  Improvement of.. I, 317; IV, 2049
Ocracoke Inlet, N. C., improvement of......................... I, 155; II, 996

Office of the Chief of Engineers.. I, 444
Officers of Corps of Engineers. *See* Corps of Engineers.
Ogdensburg Harbor, N. Y., improvement of........................ I, 389; IV, 2491
Ohio River:
  Beaver River, Pa., construction of dam below.................. I, 287; III, 1870
  Bridge at East Liverpool, Ohio, construction of.......................... I, 425
  Dam No. 2, location of.. I, 287
  Davis Island Dam, operating and care of........................ I, 287; III, 1867
  Falls of, Louisville, Ky., improvement of........................ I, 293; III, 1929
  Harbor lines between Martins Ferry and Bellaire, Ohio, establishment of.. I, 423; III, 1894
  Ice harbor at mouth of Muskingum River, construction of...... I, 288; III, 1874
  Ice harbors at mouths of Crawfish and Mill creeks, Cincinnati, Ohio, examination and survey for........................ I, 289; III, 1890
  Improvement of.. I, 285; III, 1836
  Indiana Chute, improvement of........................ I, 295; III, 1933
  Louisville and Portland Canal, operating and care of........... I, 295; III, 1935
  Snagboat on, operating.. I, 287; III, 1864
  Wrecks in, removal of.. I, 289; III, 1889
Olcott Harbor, N. Y., improvement of........................ I, 382; IV, 2450
Old Chatham Roads, Mass., removal of wreck in........................ I, 63, 613
Olympia, Wash., improvement of harbor at........................ I, 411; IV, 2606
Onancock Harbor, Va., improvement of........................ I, 130; II, 902
Ontario, Lake:
  See also Northern and Northwestern Lakes.
  Water levels.. I, 441; VI, 3430, 3436
Ontonagon, Mich., improvement of harbor at........................ I, 311; IV, 2026
Orange County, Tex., construction of bridge across Cow Bayou by........... I, 426
Osage River, Mo., improvement of........................ I, 260; III, 1620
Oswego Harbor, N. Y., improvement of........................ I, 386; IV, 2476
Otter Creek, Vt., improvement of........................ I, 391; IV, 2497
Ouachita River, Ark. and La., improvement of........................ I, 241; III, 1455
Outer Middle Ground, Chesapeake Bay, removal of wreck on........... I, 152; II, 987

P.

Paducah, Ky., preservation of Livingston Point, near............... I, 275; III, 1792
Pamlico River, N. C., improvement of........................ I, 156; II, 1019
Pamunkey River, Va., improvement of........................ I, 145; II, 968
Panther (steamer), removal of wreck of........................ I, 82, 713
Parkers River, Mass., removal of wreck near........................ I, 63, 620
Pascagoula River, Miss., improvement of........................ I, 215; II, 1319
Pasquotank River, N. C., improvement of........................ I, 154; II, 994
Passaic County, N. J., construction of bridge across Passaic River at Passaic by. I, 428
Passaic, N. J., construction of bridge across Passaic River................ I, 428
Passaic River, N. J.:
  Above Newark, improvement of........................ I, 100, 802
  Below Newark, improvement of........................ I, 99, 801
  Bridge at Passaic, construction of........................ I, 428
  Improvement of.. I, 99, 801
Patapsco River, Md.:
  Improvement of, and channel to Baltimore........................ I, 132; II, 909
  Improvement of channel to Curtis Bay........................ I, 133; II, 914
Patchogue River, N. Y.:
  Establishment of harbor lines........................ I, 422, 719
  Improvement of.. I, 81, 705
Patuxent River, Md.:
  Bridge at Mount Calvert, construction of........................ I, 428
  Improvement of.. I, 141; II, 953
Pawcatuck River, R. I. and Conn., improvement of........................ I, 60, 600
Pawtucket River, R. I.:
  Improvement of.. I, 55, 587
  Removal of wreck in.. I, 63, 620
Pawtucket, R. I., removal of wreck at........................ I, 63, 620
Pearl River, Miss., improvement of:
  Below Jackson.. I, 217; II, 1326
  Between Jackson and Carthage........................ I, 217; II, 1328
  Between Carthage and Edinburg........................ I, 218; II, 1329
Pease Creek, Fla., improvement of........................ I, 191; II, 1236

Pelican (schooner), removal of wreck of .... I, 378; IV, 2426
Pennypack Creek, Pa., construction of bridge across, at Philadelphia .... I, 429
Penobscot River, Me., improvement of .... I, 24, 499
Pensacola Harbor, Fla.:
  Defense of .... I, 6, 10, 11
  Improvement of .... I, 203; II, 1268
Pensaukee Harbor, Wis., improvement of .... I, 318; IV, 2052
Pentwater Harbor, Mich., improvement of .... I, 347; IV, 2218
Perit (steamer), removal of wreck of .... I, 49, 568
Perrere, Asa H. (schooner), removal of wreck of .... I, 63, 618
Petaluma Creek, Cal., improvement of .... I, 400; IV, 2538
Petit Jean River, Ark., improvement of .... I, 253; III, 1546
Petoskey Harbor, Mich., improvement of .... I, 353; IV, 2235
Philadelphia, Pa., construction of bridge across Pennypack Creek by city of .. I, 429
Philadelphia Harbor, Pa.:
  Establishment of harbor lines .... I, 423; II, 864
  Defense of .... I, 6, 9, 11
  Improvement of .... I, 108, 110; II, 827, 836
  Mifflin, Fort, sale of Government land in vicinity of .... I, 461
Piers built by the United States, occupancy or injury of .... I, 20, 431; VI, 3189
Pigeon bayous, La., improvement of .... I, 224; III, 1361
Pittsburg, Pa.:
  Bridge across Monongahela River, construction of, by city of .... I, 426
  Davis Island Dam, Ohio River, near, operating and care of .... I, 287; III, 1867
  Herr Island Dam, Allegheny River, near, construction of .... I, 292; III, 1918
  Wrecks in Ohio River below, removal of .... I, 289; III, 1889
Plaquemine, Bayou, La.:
  Improvement of .... I, 224; III, 1361
  Prevention of caving at mouth of .... I, 232; III, 1385
Platforms, gun and mortar .... I, 12
Plattsburg Harbor, N. Y., improvement of .... I, 390; IV, 2495
Plymouth Harbor, Mass., improvement of .... I, 47, 560
Point Breeze, Schuylkill River, removal of wreck below .... I, 118; II, 862
Point Judith, R. I., improvement of harbor of refuge at .... I, 58, 596
Point San Pablo, Cal., establishment of harbor lines in San Francisco Bay at .... I, 424; IV, 2565
Pollock Rip Channel, Mass., removal of wreck in .... I, 62, 604
Pontchartrain, Lake, La., removal of wreck in .... I, 232; III, 1383
Pontchatoula River, La., improvement of .... I, 221; III, 1352
Popes Island, Va., removal of wreck off .... II, 977
Porcupine Island, Me., construction of breakwater from Mount Desert to .. I, 23, 493
Port Chester Harbor, N. Y., improvement of .... I, 76, 68[illegible]
Port Clinton Harbor, Ohio, improvement of .... I, 370; IV, 2394
Port Bay, N. Y., improvement of Niagara River to .... I, 381; IV, 2447
Port Huron, Mich., improvement of Black River at .... I, 358; IV, 2251
Port Jefferson Harbor, N. Y., improvement of .... I, 78, 694
Port Norfolk, Va., construction of bridge across Western Branch of Elizabeth River .... I, 429
Port Royal and Augusta Railway Company, bridge of .... I, 429
Port Washington Harbor, Wis., improvement of .... I, 325; IV, 2079
Portage Lake and Lake Superior ship canals, Mich:
  Improvement of .... I, 312; IV, 2029
  Operating and care of .... I, 313; IV, 2029
Portage Lake, Houghton County, Mich., waterway across Keweenaw Point via:
  Improvement of .... I, 312; IV, 2029
  Operating and care of .... I, 313; IV, 2029
Portage Lake, Manistee County, Mich., improvement of harbor of refuge at .... I, 350; IV, 2228
Portage River, Houghton County, Mich., waterway across Keweenaw Point via:
  Improvement of .... I, 312; IV, 2029
  Operating and care of .... I, 313; IV, 2029
Portland Harbor, Me.:
  Cushings Island, site for fortification .... I, 13
  Defense of .... I, 6
  Improvement of .... I, 30, 514
  Improvement of channel in Back Cove .... I, 31, 517
Portland, Oreg.:
  Defense of harbor at .... I, 5
  Willamette River above, improvement of .... I, 417; IV, 2659
  Willamette River below, improvement of .... I, 416; IV, 2654

Potomac River:
  Eastern Branch of (Anacostia River), improvement of I, 138; II, 939
  Great Falls, erection of fish ways at I, 435; VI, 3224
  Great Falls, use of water power for electric lighting VI, 3256
  Washington, D. C., improvement at I, 135; II, 925
  Wreck in Washington Channel, removal of I, 145; II, 971
Potsburg Creek, Fla., alteration of bridge obstructing I, 431
Powow River, Mass., improvement of I, 37, 533
Presque Isle Peninsula, Erie Harbor, Pa., preservation of I, 379; IV, 2433
Presqu' Ile, Mich., removal of wreck in harbor of I, 361; IV, 2257
Providence River, R. I.:
  Improvement of I, 56, 589
  Removal of Green Jacket Shoal I, 57, 592
  Removal of wreck in I, 62, 612
Provincetown Harbor, Mass.:
  Improvement of I, 48, 564
  Removal of wreck in I, 49, 568
Public buildings and grounds, District of Columbia I, 435, VI, 3265
Public works of the United States, occupancy or injury of I, 20, 431; VI, 3189
Puget Sound:
  Defense of I, 5
  Improvement of, and tributaries, Washington I, 412; IV, 2619
Pultneyville Harbor, N. Y., improvement of I, 384; IV, 2460

Q.

Quincy Bay, Ill. *See* Mississippi River improvement between Minneapolis and mouth of Missouri River.

R.

Racine Harbor, Wis.:
  Improvement of I, 326; IV, 2094
  Removal of wrecks in Root River I, 330; IV, 2124
Raft-towing on the Great Lakes and connecting waters I, 368; IV, 2378
Rahway River, N. J., improvement of I, 101, 807
Rancocas River, N. J., improvement of I, 115; II, 854
Rappahannock River, Va., improvement of I, 142; II, 954
Raritan Bay, N. J., improvement of I, 94, 780
Raritan River, N. J., improvement of I, 102, 808
Raymond, Lizzie (schooner), removal of wreck of I, 82, 714
Raymond, Stephen (schooner), removal of wreck of I, 63, 615
Reconnaissances, explorations, and surveys in military departments I, 443; VI, 3451
Red Hook Channel, New York Harbor, N. Y., improvement of I, 91, 764
Red River, La. and Ark.:
  Improvement of I, 238; III, 1415
  Improvement of, above Fulton, Ark I, 240; III, 1452
Red River of the North, Minn. and N. Dak., improvement of I, 268; III, 1728
Red Wing, Minn., construction of bridge across Mississippi River by city of I, 425
Redwood Creek, Cal., improvement of I, 394; IV, 2509
Rivers and harbors:
  Estimates for examinations, surveys, and contingencies of I, 419
  Estimates for improvement of I, 19
  Improvement of I, 19
Roanoke River, N. C., improvement of I, 153; II, 989
Rockland Harbor, Me., improvement of I, 27, 506
Rogers (schooner), removal of wreck of I, 62, 608
Rokes, Nellie F. (schooner), removal of wreck of I, 62, 607
Rondout Harbor, N. Y., improvement of I, 84, 736
Root River, Wis., removal of wrecks at Racine I, 330; IV, 2124
Rouge River, Mich.:
  Improvement of I, 360; IV, 2255
  Turning basin in I, 361; IV, 2257
Rough River, Ky., improvement of I, 303; III, 1978
Rouse Point, Lake Champlain, N. Y., breakwater at I, 390; IV, 2492
Rumsey, Ky., reconstruction of Lock No. 2, Green River, at I, 302; III, 1968

S.

Sabine Pass, Tex., improvement of harbor at .... I, 230; III, 1375
Sabine River, Tex., improvement of .... I, 231; III, 1379
Sacketts Harbor, N. Y., improvement of harbor at .... I, 388; IV, 2488
Saco River, Me., improvement of .... I, 32, 519
Sacramento River, Cal:
  Improvement of .... I, 399; IV, 2533
  Improvement of, and tributaries .... I, 421; VI, 3174
Saginaw River, Mich., improvement of .... I, 355; IV, 2243
Saint Augustine Harbor, Fla., improvement of .... I, 187; II, 1223
Saint Clair Flats Canal, Mich.:
  Improvement of .... I, 365; IV, 2371
  Operating and care of .... I, 366; IV, 2373
Saint Croix River, Me., improvement of .... I, 20, 489
Saint Croix River, Wis. and Minn.:
  Improvement of .... I, 266; III, 1721
  Reservoirs at sources of, surveys for .... III, 1736
Saint Francis River, Mo. and Ark.:
  Examination of Walnut Bend, Mississippi River, for prevention of cut into the .... I, 225; III, 1560
  Improvement of, in Arkansas .... I, 255; III, 1557
  Improvement of, in Missouri .... I, 255; III, 1564
Saint Georges Creek, Md., removal of wreck in .... I, 145; II, 970
Saint Georges River, Md., removal of wreck in .... I, 145; II, 970
Saint Johns County, Fla., bridge of .... I, 431
Saint Johns River, Fla.:
  Improvement of (from Jacksonville to the ocean) .... I, 182; II, 1211
  Improvement of upper river .... I, 185; II, 1218
  Improvement of Volusia Bar .... I, 186; II, 1220
Saint Joseph Harbor, Mich.:
  Establishment of harbor line .... I, 424; IV, 2258
  Improvement of .... I, 339; IV, 2192
Saint Joseph River, Mich., improvement of .... I, 340; IV, 2197
Saint Lawrence Railway Company, bridge of .... I, 425
Saint Lawrence River, N. Y.:
  Bridge at Morristown, construction of .... I, 425
  Improvement of shoals between Sister Islands and Cross-over Light I, 389; IV, 2489
  Reexamination of .... I, 440; VI, 3428
Saint Louis Bay, Wis., improvement of .... I, 310; IV, 2019
Saint Louis Harbor, Mo., improvement of .... I, 258; III, 1615
Saint Marys Falls Canal, Mich.:
  Operating and care of .... I, 363; IV, 2267
  Water levels at Sault Ste Marie .... I, 441; VI, 3319, 3430
Saint Marys River, Mich.:
  Improvement of, at the falls .... I, 363; IV, 2287
  Improvement of Hay Lake Channel .... I, 364; IV, 2367
  Operating and care of St. Marys Falls Canal .... I, 363; IV, 2267
  Resurvey of, from Whitefish Bay to Detour light-house .... I, 439; VI, 3317
  Water levels .... I, 441; VI, 3319, 3430
Saint Paul, Minn., ganging Mississippi River at .... I, 269; III, 1732
Saint Paul (South), Minn., construction of bridge across Mississippi River ... I, 425
Salem Harbor, Mass., improvement of .... I, 41, 543
Salem River, N. J.:
  Improvement of .... I, 116; II, 857
  Removal of wreck in Delaware River at entrance to .... I, 118; II, 862
Salkahatchie River, S. C., improvement of .... I, 173; II, 1121
San Bernard River, Tex., construction of bridge at Churchills Ferry .... I, 426
San Diego, Cal., defense of .... I, 5
San Diego Harbor, Cal., improvement of .... I, 396; IV, 2514
San Francisco Bay, Cal.:
  Defense of San Francisco Harbor .... I, 5, 6, 10, 465
  Establishment of harbor lines .... I, 424; IV, 2505, 2506
  Improvement of Oakland Harbor .... I, 392; IV, 2501
San Francisco Harbor, Cal.:
  Defense of .... I, 5, 6, 10, 465
  Establishment of harbor lines .... I, 424; IV, 2505
San Joaquin River, Cal.:
  Improvement of .... I, 398; IV, 2527
  Improvement of, and tributaries .... I, 421; VI, 3174

- San Luis Obispo Harbor, Cal., improvement of ... I, 394; IV, 2509
- San Pablo, Point, Cal., establishment of harbor lines in San Francisco Bay at ... I, 424; IV, 2505
- Sand Beach, Lake Huron, Mich., improvement of harbor of refuge at. I, 356; IV, 2247
- Sandusky Harbor, Ohio, improvement of ... I, 371; IV, 2396
- Sandusky River, Ohio, improvement of ... I, 372; IV, 2398
- Sandy Bay, Cape Ann, Mass., improvement of harbor of refuge at ... I, 39, 536
- Santee River, S. C., improvement of ... I, 170; II, 1084
- Sarasota Bay, Fla., improvement of ... I, 191; II, 1237
- Saugatuck Harbor, Mich., improvement of ... I, 341; IV, 2201
- Saugatuck River, Conn., improvement of ... I, 73, 667
- Saugerties Harbor, N. Y., improvement of ... I, 84, 734
- Savannah, Florida and Western Railway Company, bridge of ... I, 426
- Savannah, Ga., improvement of inside route between Fernandina, Fla., and ... I, 182; II, 1206
- Savannah Harbor, Ga.:
  - Defense of ... I, 6, 10
  - Improvement of ... I, 174; II, 1129
  - Removal of wrecks in ... I, 182; II, 1209
- Savannah River, Ga.:
  - Bridge near Augusta, protection of, etc ... I, 429
  - Improvement of, above Augusta ... I, 177; II, 1164
  - Improvement of, between Augusta and Savannah ... I, 176; II, 1158
  - Improvement of Savannah Harbor ... I, 174; II, 1129
  - Removal of wrecks in Savannah Harbor ... I, 182; II, 1209
- Sayville, N. Y., improvement of Browns Creek ... I, 81, 708
- Schuylkill River, Pa.:
  - Improvement of ... I, 111; II, 846
  - Removal of wreck in ... I, 118; II, 862
  - Sale of Government land at mouth of, in vicinity of Fort Mifflin ... I, 461
- Scituate Harbor, Mass., improvement of ... I, 46, 558
- Sea Bright, N. J., establishment of harbor lines in Shrewsbury River near I, 423, 823
- Sea-coast defenses. *See* Fortifications.
- Sea Shore Road Company, bridge of ... I, 428
- Sea walls ... I, 14
- *Shannon, R. H.* (vessel), removal of wreck of ... I, 62, 609
- Sheboygan Harbor, Wis., improvement of ... I, 324; IV, 2075
- Sheepshead Bay, N. Y., improvement of ... I, 96, 796
- Ship Island Harbor, Mississippi Sound, removal of wreck in ... I, 232; III, 1384
- Shoal Harbor, N. J., improvement of ... I, 105, 818
- Shovelful Shoal, Mass., removal of wreck on ... I, 62, 606
- Shrewsbury River, N. J.:
  - Establishment of harbor lines near Sea Bright ... I, 423, 823
  - Improvement of ... I, 106, 819
- Silver Springs, Ocala and Gulf Railroad Company, bridge of ... I, 429
- Sister Islands, St. Lawrence River, N. Y., improvement of shoals near. I, 389; IV, 2489
- Siuslaw River, Oreg., improvement of mouth of ... I, 405; IV, 2573
- Skagit River, Wash., improvement of (Puget Sound and tributaries). I, 412; IV, 2619
- Skamokawa Creek, Wash., construction of bridge across ... I, 429
- Smith Island, Delaware River, removal of wreck above ... I, 117; II, 861
- Smyrna River, Del., improvement of ... I, 120; II, 876
- Snake River, Wash. and Idaho:
  - Improvement of, between Huntington Bridge and Seven Devils mining district ... I, 407; IV, 2589
  - Improvement of Upper Columbia River and ... I, 408; IV, 2590
- Snohomish County, Wash., construction of bridge across Stillaquamish River by ... I, 429
- Snohomish River, Wash., improvement of (Puget Sound and tributaries) ... I, 412; IV, 2619
- Snoqualmie River, Wash., improvement of (Puget Sound and tributaries) ... I, 412; IV, 2619
- South Chicago, Ill.:
  - Alteration of bridge across Calumet River ... I, 430
  - Construction of bridge across Calumet River ... I, 425
- South Haven Harbor, Mich., improvement of ... I, 341; IV, 2198
- South Pass, Mississippi River, inspection of improvement of ... I, 20, 219; III, 1333
- South River, N. J., improvement of ... I, 103, 813
- South St. Paul Belt Railroad Company, bridge of ... I, 425
- South St. Paul, Minn., construction of bridge across Mississippi River ... I, 425
- Southampton, N. Y., removal of wreck off ... I, 82, 713

Spuyten Duyvil Creek, N. Y., reconstruction of bridge across .... I, 430
Squan River, N. J. *See* Manasquan River.
Squaw Island, N. Y., establishment of harbor lines .... I, 424; IV, 2452
Stamford Harbor, Conn., improvement of .... I, 75, 677
Staten Island and New Jersey, improvement of channel between ....I, 98, 799
Steele Bayou, Miss., improvement of .... I, 248; III, 1511
Stillaguamish River, Wash.:
  Improvement of (Puget Sound and tributaries) .... I, 412; IV, 2610
  Construction of bridge across .... I, 429
Stillaquamish River, Wash. *See* Stillaguamish River.
Stonington, Conn., improvement of harbor of refuge at .... I, 61, 692
Structures built by the United States, occupancy or injury of.... I, 20, 431; VI, 3189
Sturgeon Bay, Wis., construction of bridge across .... I, 428
Sturgeon Bay and Lake Michigan Ship Canal, Wis.:
  Improvement of .... I, 319; IV, 2056
  Improvement of harbor of refuge at eastern entrance .... I, 321; IV, 2062
  Operating and care of .... I, 320; IV, 2058
Submarine mines .... I, 6
Sullivans Island, S. C.:
  Bridge obstructing cove at, alteration of .... I, 431
  Improvement of .... I, 172; II, 1101
  Site for fortification .... I, 13
Sumpawanus Inlet, N. Y., improvement of .... I, 95, 794
Sunken Meadow, East River, N. Y., removal of wrecks off .... I, 95, 785, 786
Superior Bay, Wis.:
  Improvement of .... I, 310; IV, 2019
  Modification of harbor lines .... I, 423; IV, 2039
Superior, Lake:
  See also Northern and Northwestern Lakes.
  Improvement of waterway across Keweenaw Point from Keweenaw Bay .... I, 312; IV, 2029
  Operating and care of waterway across Keweenaw Point from Keweenaw Bay .... I, 313; IV, 2039
  Water levels .... I, 441; VI, 3139
Supervisor of the harbor of New York .... I, 420; IV, 2681
Surveys, examinations, and contingencies of rivers and harbors, estimates for. I, 419
Surveys, reconnaissances, and explorations in military departments . I, 443; VI, 3451
Susquehanna River, vicinity of Havre de Grace, Md., improvement of. I, 124; II, 886
Sussex County, Del., construction of temporary bridge across canal connecting Chincoteague and Delaware bays by .... I, 430
Suwanee River, Fla., improvement of .... I, 195; II, 1246
Swansboro, N. C., improvement of waterway between New River and. I, 161; II, 1037
Swash Channel, Charleston Harbor, S. C., removal of wreck in ...... I, 174; II, 1128
Swinomish Slough, Wash., improvement of .... I, 412; IV, 2611

T.

Tacoma, Wash., construction of bridge across ship channel by city of .... I, 426
Talisman (tug), removal of wreck of .... I, 95, 785
Tallahatchee River, Miss , improvement of .... I, 247; III, 1508
Tampa, Fla., construction of bridge across Hillsborough River .... I, 426
Tampa Bay, Fla., improvement of .... I, 193; II, 1241
Tar River, N. C., improvement of .... I, 156; II, 1019
Tarentum, Pa., construction of bridge across Allegheny River below .... I, 428
Taunton River, Mass., improvement of .... I, 51, 586
Tchefuncte River, La., improvement of .... I, 220; III, 1349
Tchula Lake, Miss., improvement of .... I, 247; III, 1506
Teche, Bayou, La.:
  Bridge near Loreauville, construction of .... I, 429
  Improvement of .... I, 226; III, 1368
Tennessee River:
  Improvement of .... I, 273; III, 1787
  Improvement of, above Chattanooga, Tenn .... I, 273; III, 1787
  Improvement of, at Livingston Point, Ky .... I, 275; III, 1792
  Improvement of, below Bee Tree Shoals, Ala .... I, 274; III, 1790
  Improvement of, between Chattanooga, Tenn., and foot of Bee Tree Shoals, Ala .... I, 282; III, 1821
  Operating and care of Muscle Shoals Canal, Ala .... I, 284; III, 1828
Tensas River, La., improvement of .... I, 244; III, 1479
Terrebonne, Bayou, La., improvement of .... I, 223; III, 1360

Thames River, Conn., improvement of ... i, 64, 624
Thomas, Samuel W. (schooner), removal of wreck of ... i, 145; ii, 970
Three Mile Creek, Ala., alteration of bridge near Mobile ... i, 430
Thunder Bay Harbor, Mich., improvement of ... i, 354; iv, 2241
Thunder Bay River, Mich., improvement of ... i, 354; iv, 2241
Tickfaw River, La., and tributaries, improvement of ... i, 221; iii, 1352
Ticonderoga River, N. Y., improvement of ... i, 391; iv, 2498
Tillamook Bay and Bar, Oreg., improvement of ... i, 406; iv, 2585
Toledo Harbor, Ohio, improvement of ... i, 369; iv, 2385
Tombigbee River, Ala. and Miss., improvement of ... i, 212; ii, 1311
  Below Demopolis, Ala ... i, 212; ii, 1313
  Between Demopolis, Ala., and Columbus, Miss ... i, 213; ii, 1315
  Between Columbus and Fulton, Miss ... i, 213; ii, 1316
  Between Fulton and Walkers Bridge, Miss ... i, 214; ii, 1317
Tonawanda Harbor, N. Y., improvement of ... i, 381; iv, 2444
Tradewater River, Ky., improvement of ... i, 301; iii, 1967
Trent River, N. C.:
  Bridge obstructing, at Newbern, alteration of ... i, 431
  Improvement of ... i, 158; ii, 1025
Trinity River, Tex., improvement of ... i, 235; iii, 1401
Tug Fork of Big Sandy River, W. Va. and Ky., improvement of ... i, 306; iii, 2002
Two Rivers Harbor, Wis., improvement of ... i, 323; iv, 2069

U.

Umpqua River, Oreg., improvement of ... i, 404; iv, 2569
Undine (bark), removal of wreck of ... i, 182; ii, 1209
United States Engineer School ... i, 17, 468
United States structures, occupancy or injury of ... i, 20, 431; vi, 3189
Urbana Creek, Va., improvement of ... i, 143; ii, 959
Use of structures built by the United States ... i, 20, 431; vi, 3189

V.

Vancouver, Wash., improvement of Columbia River near ... i, 414; iv, 2643
Vermillion, Bayou, bay, and passes, La., improvement of ... i, 227; iii, 1370
Vermillion Harbor, Ohio, improvement of ... i, 373; iv, 2403
Vineyard Haven, Mass.:
  Improvement of harbor at ... i, 52, 578
  Removal of wrecks in ... i, 62, 609
Vineyard Haven Harbor, Mass.:
  Improvement of ... i, 52, 578
  Removal of wrecks in ... i, 62, 609
Volusia Bar, Fla., improvement of ... i, 186; ii, 1220

W.

Wabash River, Ind. and Ill.:
  Improvement of ... i, 296; iii, 1945
  Improvement of, above Vincennes, Ind ... i, 296; iii, 1946
  Improvement of, below Vincennes, Ind ... i, 296; iii, 1943
Waccamaw River, N. C. and S. C., improvement of ... i, 168; ii, 1067
Wahkiakum County, Wash., construction of bridge across Skamokawa Creek by ... i, 429
Walnut Bend, Mississippi River, examination for prevention of cut into St. Francis River ... i, 225; iii, 1560
Wappinger Creek, N. Y., improvement of ... i, 85, 740
Wappoo Cut, S. C., improvement of ... i, 173; ii, 1116
Wareham Harbor, Mass., improvement of ... i, 52, 580
Warren County, Miss., construction of bridge across Big Black River by ... i, 430
Warrior River, Ala.:
  Improvement of (below Tuscaloosa) ... i, 212; ii, 1311
  Improvement of, between Tuscaloosa and Daniels Creek ... i, 211; ii, 1310
Warwick River, Md., improvement of ... i, 127; ii, 894
Washington, D. C.:
  Anacostia River, improvement of ... i, 138; ii, 939
  Defense of ... i, 6, 10
  Great Falls, Potomac River, use of water power for electric lighting ... vi, 3256
  Potomac River at, improvement of ... i, 135; ii, 925
  Public buildings and grounds ... i, 435; vi, 3265
  Washington aqueduct ... i, 432; vi, 3193

Washington, D. C.—Continued.
  Washington monument .... I, 435; VI, 3267
  Water supply, increasing .... I, 434; VI, 3222
Washington and Chesapeake Beach Railway Company, bridge of .... I, 428
Washington aqueduct, Washington, D. C .... I, 432; VI, 3193
Washington Bayou, Miss., improvement of .... I, 248; III, 1511
Washington monument, Washington, D. C .... I, 435; VI, 3267
Wateree River, S. C., improvement of .... I, 171; II, 1089
Waterways:
  Between Beaufort Harbor and Newbern (on Neuse River), N. C .... I, 159; II, 1030
  Between Beaufort Harbor and New River .... I, 161; II, 1034
  Between Chincoteague Bay, Va., and Delaware Bay, near Lewes, Del., construction of bridge across canal connecting .... I, 430
  Between Chincoteague Bay, Va., and Delaware Bay, near Lewes, Del., improvement of .... I, 123; II, 884
  Between New River and Swansboro .... I, 161; II, 1037
  Between Norfolk Harbor, Va., and Albemarle Sound, N. C .... I, 151; II, 983
  Between Savannah, Ga., and Fernandina, Fla .... I, 182; II, 1206
  From Keweenaw Bay to Lake Superior, across Keweenaw Point, improvement of .... I, 312; IV, 2029
  From Keweenaw Bay to Lake Superior, across Keweenaw Point, operating and care of .... I, 313; IV, 2029
Waukegan Harbor, Ill., improvement of .... I, 328; IV, 2100
Wellfleet Harbor, Mass., improvement of .... I, 48, 563
West Galveston Bay, Tex., improvement of .... I, 235; III, 1399
West Norfolk, Va., construction of bridge across Western Branch of Elizabeth River .... I, 429
West Norfolk and Port Norfolk Drawbridge Company, bridge of .... I, 429
Westchester Creek, N. Y., establishment of harbor lines .... I, 423, 790
Westport Point, Mass., construction of bridge across East Branch of Westport River .... I, 429
Westport River, Mass., construction of bridge across East Branch of, at Westport Point .... I, 429
Weymouth River, Mass., improvement of .... I, 45, 556
White Harry (schooner), removal of wreck of .... I, 82, 711
White Lake Harbor, Mich., improvement of .... I, 346; IV, 2215
White River, Ark., improvement of .... I, 253; III, 1547
White River, Ind., improvement of .... I, 297; III, 1948
Whitehall Harbor, N. Y., improvement of .... I, 392; IV, 2499
Wicomico River, Md., improvement of .... I, 129; II, 899
Wildfire (schooner), removal of wreck of .... I, 49, 568
Willamette River, Oreg.:
  Defense of Portland .... I, 5
  Improvement of, above Portland .... I, 417; IV, 2659
  Improvement of, below Portland .... I, 416; IV, 2654
Willapa River and Harbor, Wash., improvement of .... I, 409; IV, 2595
Willets Point, N. Y.:
  Engineer Depot .... I, 18, 474
  Post of .... I, 17, 467
Wilmington and Weldon Railroad Company, bridge of .... I, 426
Wilmington Harbor, Cal., improvement of .... I, 395; IV, 2511
Wilmington Harbor, Del., improvement of .... I, 118; II, 870
Wilmington Harbor, N. C.:
  Defense of .... I, 6
  Improvement of Cape Fear River above .... I, 164; II, 1041
  Improvement of Cape Fear River at and below .... I, 164; II, 1047
  Removal of wreck in .... I, 168; II, 1065
Wilson Harbor, N. Y., improvement of .... I, 382; IV, 2148
Wilsons Point Harbor, Conn., improvement of .... I, 73, 671
Winthrop Harbor, Mass., improvement of .... I, 43, 547
Winyaw Bay, S. C., improvement of .... I, 167; II, 1059
Wisconsin Central Railroad Company, bridge of .... I, 427
Wisconsin River, Wis., surveys for reservoirs at sources of .... III, 1786
Withlacoochee River, Fla.:
  Bridge at Dunnellon, construction of .... I, 429
  Improvement of .... I, 193; II, 1242
Wolf River, Wis., construction of bridge at Gills Landing .... I, 427
Wrecks, removal of .... I, 19
  Ashley River, S. C .... I, 174; II, 1128
  Ashtabula Harbor, Ohio .... I, 378; IV, 2426

- Wrecks, removal of—Continued.
  - Barnegat Light, N. J., opposite .... I, 117; II, 861
  - Big Pigeon Bayou, La .... I, 232; III, 1383
  - Block Island Sound, R. I .... I, 82, 711
  - Brandywine Creek, Del .... I, 132; II, 907
  - Bridesburg, Pa .... I, 117; II, 861
  - Brigantine Shoal, N. J .... I, 117; II, 861
  - Browns Ledge, Mass., near .... I, 63, 619
  - Cape Fear River, N. C., in and near mouth of .... I, 168; II, 1065
  - Charles, Cape, Va., at .... I, 152; II, 987
  - Charleston Harbor, S. C .... I, 174; II, 1128
  - Chatham, Mass., near .... I, 62, 611
  - Chatham Bar, Mass .... I, 49, 568
  - Chatham Harbor, Mass .... I, 49, 568
  - Chatham Roads (Old), Mass .... I, 63, 613
  - Chesapeake Bay .... I, 132, 152; II, 906, 987
  - Christiana River, Del .... I, 132; II, 906
  - Delaware Bay, in .... II, 862
  - Delaware River, Pa. and N. J .... I, 117, 118; II, 861, 862
  - East River, N. Y .... I, 95, 785, 786
  - Elizabeth River, N. J .... I, 108, 823
  - Faulkners Island, Long Island Sound, near .... I, 82, 712
  - Gedney Channel, New York Harbor .... I, 95, 785
  - Grand River, La .... I, 232; III, 1383
  - Handkerchief light-ship, Mass., near .... I, 62, 612
  - Hatteras, Cape, N. C., near .... I, 168; II, 1065
  - Hyannis Harbor, Mass .... I, 63, 614, 615, 616
  - Kent Island, Chesapeake Bay, off .... I, 132; II, 906
  - Logstown, Pa .... I, 289; III, 1889
  - Long Island Sound, in .... I, 82, 712, 714
  - Long Sand Shoal, Long Island Sound, near .... I, 82, 714
  - Lookout, Cape, light-house, near .... I, 168; II, 1065
  - Maurice River Cove, Delaware Bay, in .... II, 862
  - Mispillion River, Del .... I, 132; II, 906
  - Mobile River, Ala .... I, 219; II, 1332
  - Monomoy Beach, Mass., near .... I, 63, 618
  - Monomoy life-saving station, Mass., near .... I, 62, 607
  - Monomoy Point, Mass., at and near .... I, 62, 63, 606, 608
  - Monomoy Point light-house, near .... I, 63, 616, 617
  - Nantucket Sound, Mass., in and near .... I, 62, 63, 604, 612, 620
  - Nautilus Shoal, Chesapeake Bay, on .... I, 152; II, 987
  - New Haven Harbor, Conn .... I, 82, 712
  - New York Harbor, N. Y .... I, 95, 785, 786
  - Ohio River below Pittsburg .... I, 289; III, 1889
  - Outer Middle Ground, Chesapeake Bay, on .... I, 152; II, 987
  - Parkers River, Mass., near .... I, 63, 620
  - Pawtucket, R. I .... I, 63, 620
  - Pittsburg, Pa., below .... I, 289; III, 1889
  - Point Breeze, Schuylkill River, below .... I, 118; II, 862
  - Pollock Rip Channel, Mass .... I, 62, 604
  - Pontchartrain, Lake, La .... I, 232; III, 1383
  - Popes Island, Va., off .... II, 907
  - Potomac River, D. C .... I, 145; II, 971
  - Presqu' Ile Harbor, Mich .... I, 361; IV, 2257
  - Providence River, R. I .... I, 62, 612
  - Provincetown Harbor, Mass .... I, 49, 568
  - Root River, Racine, Wis .... I, 330; IV, 2124
  - St. Georges Creek, Md .... I, 145; II, 970
  - St. Georges River, Md .... I, 145; II, 970
  - Savannah Harbor, Ga .... I, 182; II, 1209
  - Schuylkill River, Pa., below Point Breeze .... I, 118; II, 862
  - Ship Island Harbor, Mississippi Sound .... I, 232; III, 1384
  - Smith Island, Delaware River, above .... I, 117; II, 861
  - Southampton, N. Y., off .... I, 82, 713
  - Sunken Meadow, East River, N. Y., off .... I, 95, 785, 786
  - Vineyard Haven Harbor, Mass .... I, 62, 609

Y.

- Yamhill River, Oreg., improvement of .... I, 417; IV, 2661
- Yaukton, S. Dak., construction of bridge across Missouri River .... I, 425